08/11/2006

Linda Jacobson
RCRA Project Manager
US EPA Region VIII
8ENF-T
999 18th Street, Suite 300
Denver, Colorado 80202-2466

August 11, 2006

SENT BY FEDERAL EXPRESS

CONSENT DECREE
CIVIL ACTION NO. CV 98-3-H-CCL
EAST HELENA SITE
WORK PERFORMED IN JULY 2006
PROGRESS REPORT #100

Dear Ms. Jacobson:

On May 5, 1998, Asarco and the United States Environmental Protection Agency (EPA) entered into a Consent Decree (Decree) to further the objectives of the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act (CWA). Section XI of the Decree (Reporting: Corrective Action) requires Asarco to submit certified monthly progress reports to EPA which discuss the actions taken by Asarco in achieving compliance with the Decree. The reports are to be submitted to EPA no later than the twentieth (20th) day of the following month. The following describes only those activities that have occurred or are related to projects performed during July 2006. The historical actions taken by Asarco is achieving compliance with the Decree are contained in previous monthly progress reports.

a. Describe the actions, progress, and status of projects which have been undertaken pursuant to Part VII of the Decree;

In May 2006, Asarco provided EPA with responses to the comments from the technical experts at EPA's Office of Research and Development on the 2005 Addendum to Interim Measures Work Plan, Groundwater Interim Measures (November 2005). In a July 3, 2006 letter, EPA indicated that Asarco's responses adequately addressed the comments.

During the period of July 17-20, 2006, Roger Sharpe (Multi-Phase Technologies, LLC (MPT)) installed and adjusted the instrumentation contained within the monitoring wells located in the vicinity of the EPA PRB pilot test wall. In past months, MPT had been monitored wells TR0, TR1, T2A, and the downgradient well. The EPA Office of Research and Development is currently using the upgradient monitoring well for Discrete Multi-Level Sampling (DMLS). Historically, the installed cables were comprised of PVC insulation. The 25 cm takeouts (electrode spacings and constructed of 308 stainless) were being used in TR0 and T2A. The 50 cm takeouts were being used in TR1 and the downgradient well. With the recent changes, MPT has swapped all but 2 PVC insulated cables for cables with better insulation, and 316 stainless electrodes. MPT is now monitoring TR0, TR1, T2A and T2B with 25 cm takeouts. Per an agreement between MPT and EPA, the DMLS sampler from the upgradient well was removed with the respective samples forwarded to the EPA Office of Research and Development for analysis. MPT is now monitoring the upgradient and downgradient wells with 37.5 cm takeouts. Finally, MPT moved the 25 cm PVC cables from TR0 and T2A to T3A and T3B. A total of eight wells are now being monitored. In the fall 2006, in collaboration with EPA's scheduled return visit, MPT plans to install permanent cables in 3-4 wells located within the barrier. The wells will be installed for MPT by EPA Geo-probe equipment.

Asarco has previously provided Montana Department of Environmental Quality (MDEQ) and EPA with a listing of specific waste categories for placement within the CAMU Phase 2 Cell. Based upon input from MDEQ and EPA during an August 3, 2006 conference call, the original list has been revised. A copy of this revised list is attached to this monthly progress report. The waste material examples contained within the revised list will be continuously updated as Asarco proceeds through execution of the Montana and RCRA Consent Decree.

As prescribed in the Montana Consent Decree, Asarco submitted a revised 2006 Work Plan on July 14, 2006. This revised 2006 Work Plan included, not just the cleaning and demolition of the sinter plant, but the cleaning and demolition of the dross plant, laboratory, blast furnace flue (from the dross plant to the No.1 blast furnace), sinter plant baghouse, hot Cottrell, acid plant scrubbers, and mist precipitator building. Coincidental with the development of the revised 2006 Work Plan, Envirocon submitted the Phase 2 and 3 Decontamination and Demolition draft work plan to MDEQ. On July 20, 2006, MDEQ approved Envirocon's work plan, pending review of the associated asbestos work plan.

Under the Phase 2 and 3 Decontamination and Demolition Work Plan (and the yet to be fully developed site-wide cap plan), Asarco proposes using on-site fumed slag as backfill. The fumed slag will be placed in areas that are below grade or require drainage assistance. The fumed slag will serve as the subgrade for the interim and final cap, over which an engineered cap comprised of non-woven geotextile and RPE will be placed. In response to EPA's July 6, 2006 comments, Asarco provided the rationale for using fumed slag for this purpose, including study results derived from the RCRA Consent Decree investigations. The slag-

related investigative results contained in the Current Condition Release Assessment (CC/RA, January 1999) and a qualitative analysis of fumed slag (May 2001) is attached to this monthly progress report. In April 2005, MDEQ representatives collected fumed slag samples from the East Helena Plant to assess the potential environmental impacts from its use as an iron substitute within the cement manufacturing industry. A copy of the MDEQ April 2005 fumed slag sampling event results is attached to this monthly progress report. A July 2006 MDEQ Environmental Impact Statement (EIS) may contain additional slag related information.

Groundwater Remedial Evaluation

During July 2006, Asarco continued to evaluate groundwater remedial measures that may be applicable to the East Helena site. Most of this evaluation focused upon the action items developed during our April 25–26, 2006 meetings.

- In July 2006, Asarco continued discussions with Shaw and other potential contractors to evaluate information necessary to construct slurry walls in the former acid plant sediment drying area. The slurry wall construction in the former acid plant sediment drying area is tentatively scheduled for fall 2006 and in the speiss granulating area during calendar year 2007.

- On July 7, 2006, Asarco and Shaw Environmental personnel met at the East Helena site to further define construction logistics and to refine a more complete scope of work relative to construction of a slurry wall in the former acid plant sediment drying area.

- A cost estimate package for slurry wall construction in the former acid plant sediment drying area was submitted to other potential contractors, including Envirocon (at their request) as verification and to examine possible alternative contractors for source control work.

Pump and Treat Pilot Test

During the July 2006, CDM, Hydrometrics, and Asarco have been preparing for the upcoming pump and treat pilot test at the East Helena lead smelter. The July 2006 activities completed include:

- CDM completed the Bench-Scale Test Report for the Pump and Treat Pilot Test. This report summarizes the results of tests performed to evaluate options and costs for treating a combination of source waters in the High Density Sludge (HDS) water treatment plant. The results indicate that the HDS water treatment plant can meet MPDES discharge limits for arsenic and metals, with only minor modifications to the plant. A copy of this report is attached to this monthly progress report.

- Asarco initiated HDS water treatment plant modifications, including procuring and installing the necessary equipment to add iron and coagulant to

the neutralization reactors and installation of new valves and piping to route speiss granulating area groundwater and stormwater to the feed tank. Provisions have been made to temporarily modify the process control system for the pilot scale test.

- Hydrometrics and Asarco were scheduled to construct a new groundwater capture well in the vicinity DH-33 of the speiss granulating area. The capture well could not be installed in July 2006 because of difficulties associated with timing of the boreholes being installed in the former acid plant sediment drying area. A new drill rig is scheduled to arrive at the facility in August 2006. The new groundwater capture well is scheduled to be complete in early August 2006.

- CDM has prepared a preliminary pilot scale test plan. The plan describes the required volumes of speiss water and stormwater and outlines the two major tests to be completed. The first test will involve treatment of 100% stormwater using the new treatment approach determined during bench-scale testing. The second test will consist of treating 100% speiss granulating area water. The completion of these two tests will bracket the range of water qualities requiring treatment. The first test will be conducted at a HDS water treatment plant flow of 90 gpm while the second test will be performed at 45 gpm. The sampling and analysis will be conducted after the HDS water treatment plant reaches steady state operations and purges a volume equivalent to two residence times. The treated effluent will be routed to the spare one million gallon storage tank, rather than being directly discharged. Depending upon the quality of the treated water, the pilot test effluent may be re-treatment using the pre-pilot scale test format.

During August 2006, the pump and treat pilot scale test activities will include completing the installation of the speiss granulating area capture well, completing the HDS water treatment plant modifications, finalizing the pilot scale test plan, and modifying the plant process control system in preparation for the pilot scale test. The actual pilot scale testing is tentatively scheduled to begin in mid-August 2006 and be completed by mid-September 2006.

Corrective Action Management Unit (CAMU)

In a letter dated July 11, 2006, EPA and MDEQ concurred with Asarco's June 16, 2006 letter that outlined the geotechnical and site investigation work for the CAMU Phase 2 Cell. During a three-day period (beginning on July 24, 2006), Hydrometrics performed the geotechnical investigation by dividing the site into a grid with an approximate grid spacing of 200 ft by 200 ft. Seventeen locations were sampled using a Power Probe hydraulic push sampler. Each location was sampled to the bottom of the loam strata, which ranged from 8 to 22 feet thick. These samples will be tested for plasticity and gravel, sand, and fines content. Because of the variation in the loam strata thickness, 10 additional boreholes in the area located southeast of the CAMU Phase 1 Cell will be needed to better quantify the volume of material available to construct the clay liner. Work on

these additional boreholes is scheduled to begin on August 2, 2006. The analyses of the collected samples will begin later in August 2006. Once this data is analyzed, approximately five additional bulk samples will be collected in the field from test pits that will provide material that best represents the material selected for construction of the compacted clay liner. These samples will be sent to a soil laboratory to determine the permeability of the soil when compacted to 95% of maximum Proctor density.

During a two-week period beginning on July 17, 2006, ENTACT Environmental Services conducted a facility-wide waste volume survey. ENTACT is schedule to provide Asarco with the facility wide waste volume survey in early August 2006.

On July 10, 2006, Hydrometrics performed the first 5-year, periodic technical inspection of the CAMU Phase 1 Cell. The inspection noted that the condition of the vegetation throughout the entire site is well established and no signs of noxious weeds present. No erosion, seepage, or surface cracking is apparent over the entire CAMU. Storm water conveyances are clean, and show no signs of erosion or blockage from vegetation or sedimentation. Security at the site is good. The monitoring wells are equipped with locked lids. The perimeter fence is in good condition, kept locked, and public access is prohibited. There were only two minor shortcomings noted. A mouse burrow is present near the toe of the northeast slope that needs to be monitored to ensure that mice do not infest the CAMU lining. Rodenticide is selectively applied in impacted areas to control mice over the CAMU. In addition, a corrugated drainpipe on the northeast toe of the CAMU slope was exposed and cracked in several places. Asarco competed the repair of this drainpipe on July 13, 2006. The technical inspection report is scheduled to be submitted in the August 2006 monthly progress report.

Groundwater Drilling Program

On July 14, 2006, Asarco submitted to EPA and MDEQ the 2006 Addendum to Interim Measures Work Plan, East Helena Facility, 2006 Supplemental Monitoring Wells and Bore Hole. This Work Plan set forth the drilling program that is necessary to 1) confirm the stratigraphy in the speiss granulating area, 2) provide groundwater for the pump and treat pilot scale test, 3) identify the location of the ash unit in the former acid plant sediment drying area, 4) define the outer limits of arsenic plume in proposed PRB area, and 5) establish a baseline of groundwater quality in the CAMU Phase 2 Cell area.

The 2006 Supplemental Monitoring well and Bore Hole drilling program was initiated in late July 2006 in the former acid plant sediment drying area. Boland Drilling completed one borehole that was advanced to 31 feet, where the ash layer was encountered. Although site conditions were discussed prior to the initiation of the project, drilling the borehole was more difficult than the drilling contractor had anticipated. After completion of the one borehole, the drilling program was temporarily suspended until the contactor could equip a drilling rig with an O-dex or Tubec drilling system. This system allows the advancement of casing through

the cobbles and boulders that are typical of the site while still providing more efficient and timely sample collection using split spoons. This system was widely used for previous borehole and monitoring well drilling programs at the East Helena site.

The primary purpose of borehole drilling in the former acid plant sediment drying is to provide information for slurry wall design, including target depth. Of particular interest is the presence or absence of a clay layer at about 20 feet. Although a thin (about 1 foot) clay layer was encountered at 20 feet, it does not appear thick enough to key the slurry wall. It is now expected that a slurry wall in the former acid plant sediment drying area would have to be advanced to the ash layer for proper completion.

Long-Term RI/FS Monitoring Program

The analytical results from the May 2006 semi-annual sampling of the designated monitoring wells and surface water sites as prescribed in Asarco's on-going Post Remedial Investigation (RI)/Feasibility Study (FS), Long Term Monitoring Program were received from Energy Laboratory in late June 2006. As previously reported in the June 2006 monthly progress report, some of the monitoring wells located in northern part of the City of East Helena (EH-100 series) that were sampled in May 2006 exhibited low but detectable arsenic concentrations ranging from 0.002 mg/l to 0.008 mg/l. The validation summary from the May 2006 semi-annual sampling event is attached to this monthly progress report.

Since historical arsenic results from these monitoring wells have been typically below laboratory detection limits, a supplemental set of groundwater sampling of these wells was conducted in June 2006. The June 2006 sampling was performed after the monitoring wells were supplied with new sampling tubing and new sample pump equipment. The recently received June 2006 supplemental monitoring well sample results were similar to the results obtained from the May 2006 event and appear to confirm the low level arsenic results.

The water quality of the identified monitoring wells remain less than the Montana Human Health Standards (0.010 mg/L, effective January 23, 2006) and Federal Maximum Contaminant Level (MCL)/Action Levels (0.010 mg/L). Asarco recommends that additional monitoring at an increased frequency take place to confirm the May 2006 and June 2006 results and to determine if an increasing arsenic concentration trend is apparent. Based upon concurrence with EPA Region VIII technical experts, Asarco will perform supplemental groundwater monitoring well sampling (from the EH-100 series) in September 2006. This supplemental information will be helpful for decision making relative to potential future groundwater actions in the East Helena area.

In addition, an evaluation is ongoing to access the possibility of a laboratory source that may be responsible for the recent trends in detectable arsenic levels at the groundwater monitoring wells. A laboratory error source remains a high possibility

since the original RI/FS project detection limit for arsenic was 0.005 mg/L, instead of the current 0.002 mg/L. The original 0.005 mg/L detection limit is a reportable value that most laboratories feel is comfortable in attaining with less possibility for error.

On July 12 2006, Asarco completed the bi-monthly residential groundwater well sampling outlined in Asarco's on-going Post Remedial Investigation (RI)/Feasibility Study (FS), Long Term Monitoring Program. Under this program, the Nordstrom and Jones (formerly Yuricic) irrigation groundwater wells and the Corbett (formerly Marcum) and Jensen residential groundwater drinking water wells were sampled. In addition, the Helfert groundwater well was also sampled to validate the May 2006 analytical arsenic result. The analytical dissolved arsenic results obtained from the Nordstorm, Colbert, and Helfert groundwater wells were below the laboratory detection limit of 0.002 mg/L. The analytical dissolved arsenic result obtained from the Jensen groundwater well was measured at the laboratory detection limit of 0.002 mg/L. Since the 0.002 mg/L value is essential the same as the instrument detection limit, occasional "noise" will result in detectable values at this very lower detection limit. Consequently, detectible values at the 0.002 mg/L limit are not considered significant.

The July 12, 2006 groundwater arsenic sample result from the Jones irrigation groundwater well was 0.006 mg/L. This arsenic result is not consistent with previous monitoring data and indicates a very small change from historical baseline data. On July 24, a follow up sample was collected from the Jones irrigation groundwater well. The analytical dissolved arsenic results obtained from this follow-up sampling was 0.006 mg/L and 0.005 mg/L for the original and duplicate samples, respectively. Asarco is investigating the possible reasons for the atypical but detectable arsenic results in the Jones' irrigation well. The next bi-monthly sampling of the Jones' irrigation well is scheduled in September 2006.

A summary of the correspondence transmitted as part of the East Helena Consent Decree in July 2006 is included in Attachment 1.

b. Identify any requirements under the Part VII of the Decree that were not completed in a timely manner, and problems or anticipated problem areas affecting compliance with the Decree;

There were no requirements that were not completed in a timely manner nor were there problems or anticipated problem areas that affect compliance with the Decree. The subsurface site conditions presented difficulties in drilling the boreholes in the former acid sediment drying area. The drilling program has been temporarily suspended until the contactor can equip a drilling rig with an O-dex or Tubec drilling system.

c. Describe projects completed during the prior month, as well as activities scheduled for the next month;

In accordance with the March 2000 Groundwater Source Control Interim Measures Design Analysis, Plans, and Specification report, the speiss handling area and the former acid plant sediment drying area are being inspected monthly with the last inspection occurring on July 5, 2006. This monthly inspection documented the condition of the interim measures within these two areas.

CAMU Landfill - The construction of the CAMU landfill is complete. The Final Construction Report for the CAMU-Phase 1 Cell was hand-delivered to EPA on January 23, 2002. In accordance with the July 2000 CAMU Design Analysis Report (Operation and Maintenance Plan), the CAMU is being inspected monthly with the last inspection occurring on July 10, 2006. This monthly inspection documented the condition of the CAMU.

During August 2006, Asarco will continue to work on the RCRA Consent Decree program with particular emphasis on 1) resolving design issues related to interim capping and drainage details, 2) evaluating groundwater remedial measures, 3) determining the volume of material to be placed in the CAMU Phase 2 Cell, 4) continuing with the CAMU Phase 2 Cell geotechnical and site investigation, 5) continuing with the evaluation of alternate PRB media, 6) conducting the pilot scale pump and treat project, 7) continuing with the groundwater drilling program, 8) evaluating recent arsenic results in groundwater monitoring and irrigation wells, and 9) preparing the CMS for former acid sediment drying area.

d. Describe and estimate the percentage of studies completed;

The Pump and Treat Pilot Scale Testing for Source Area Reduction of Groundwater Contamination is approximately 80% complete.

e. Describe and summarize all findings to date;

The details of past findings through June 2006 are described and summarized in previous monthly progress reports.

f. Describe actions being taken to address problems;

There were no actions taken to address problems associated with the Decree.

g. Identify changes in key personnel during the period;

Asarco continues to use the services of Asarco technical personnel and Hydrometrics Incorporated to perform the various activities required under the Consent Decree. The Consent Decree activities will continue to be administrated under the direction of Robert Miller.

h. **Include copies of the results of sampling and tests conducted and other data generated pursuant to work performed under Part VII of the Decree since the last Progress Report. Asarco may submit data that has been validated and confirmed by Asarco to supplement any prior submitted data. Updated validated and confirmed data shall be included with the RFI Report, if not delivered before;**

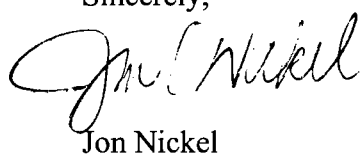
One validation package, entitled "Validation Summary, Asarco East Helena, Post RI/FS Long-Term Monitoring Project, Surface Water, Groundwater, and CAMU Wells, Semi-Annual Sampling Event, Inorganic Analyses, May 2006" is attached to this progress report.

The Energy Laboratory raw analytical sample results obtained from the July 2006 Post Remedial Investigation (RI)/Feasibility Study (FS), Long Term Monitoring Program (Bi-Monthly Residential Groundwater Wells) are attached to this monthly progress report. This data is currently being validated and the data validation report will be submitted once completed.

i. **Describe the status of financial assurance mechanisms, including whether any changes have occurred, or are expected to occur which might affect them, and the status of efforts to bring such mechanisms back into compliance with the requirements of this Decree.**

ASARCO filed a voluntary petition for relief under chapter 11 of Title 11 of the United States Bankruptcy Code in the Southern District of Texas on August 9, 2005. ASARCO hopes to use its chapter 11 bankruptcy proceeding to improve its financial position to the point where it can successfully reorganize and immerge from bankruptcy. ASARCO further hopes that at that time it will be in a position to make the required financial assurance demonstration.

Sincerely,

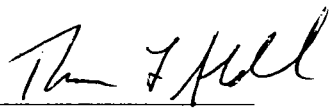


Jon Nickel

Cc: Denise A. Kirkpatrick, MDEQ

CERTIFICATION
PURSUANT TO U.S. v ASARCO INCORPORATED
(CV-98-3-H-CCL, USDC, D. Montana)

I certify under penalty of law that this document, July 2006 Progress Report and all attachments, were prepared under my direct supervision in accordance with a system designed to assure that qualified personnel gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations.

Signature 
Name: Thomas L. Aldrich
Title: Vice President Environmental Affairs
Date: August 10, 2006

CONSENT DECREE
EAST HELENA SITE
JULY 2006 PROGRESS REPORT

SUMMARY OF CORRESPONDENCE
ATTACHMENT 1

DATE OF TRANSMITTAL	CORRESPONDENCE SENT FROM	CORRESPONDENCE SENT TO	SUBJECT	RESPONSE
Attached to This Progress Report	Jon Nickel	Linda Jacobson	Revised List of Specific Waste Categories for Placement in CAMU Phase 2 Cell	Approved by MDEQ and EPA - No Formal Response Required
Attached to This Progress Report	Jon Nickel	Linda Jacobson	Summary of Slag Testing Analyses Including Test Basin Water Quality, Slag Bottle Roll Tests and EP Toxicity Tests, Fumed Slag TCLP and Total Metal Analyses (May 2001), and MDEQ Sample Results	Awaiting Approval to Use Fumed Slag as Fill Media
July 14, 2006	Bob Miller	Linda Jacobson	2006 Addendum to Interim Measures Work Plan - 2006 Supplemental Monitoring Wells and Boreholes	Awaiting EPA Approval
Attached to This Progress Report	Jon Nickel	Linda Jacobson	Bench Scale Test Results for Pump and Treat Pilot Test	No Formal Response Required

Attached to This Progress Report	Jon Nickel	Linda Jacobson	Validation Summary, Asarco East Helena, Post RI/FS Long-Term Monitoring Project, Surface Water, Groundwater, and CAMU Wells, Semi-Annual Sampling Event, Inorganic Analyses, May 2006	No Formal Response Required
Attached to This Progress Report	Jon Nickel	Linda Jacobson	Raw Analytical Data for July 2006 Post RI/FS Long-Term Monitoring Program	No Formal Response Required

July 2006 Consent Decree Progress Report

Summary of Slag Testing Analyses

Test Basin Water Quality, Slag Bottle Roll Tests, and EP Toxicity Tests Fumed Slag TCLP and Total Metal Analyses (May 2001), and April 14, 2005 Montana Department of Environmental Quality Results

APPENDIX 4-1-2

SUMMARY OF SLAG TESTING ANALYSES INCLUDING TEST BASIN WATER QUALITY, SLAG BOTTLE ROLL TESTS AND EP TOXICITY TESTS

[illegible] SLAG WATER MONITOR ANALYSES - ASARCO EAST HELENA

SITE NAME	FUMED SLAG	FUMED SLAG	FUMED SLAG	FUMED SLAG	FUMED SLAG	FUMED SLAG	FUMED SLAG	FUMED SLAG	FUMED SLAG	FUMED SLAG
SAMPLE DATE	12/30/86	04/02/87	04/22/87	04/22/87	05/22/87	05/22/87	05/22/87	05/22/87	07/15/87	07/15/87
LAB	ASARCO	ASARCO	ASARCO	CHMTC	ASARCO	ASARCO	CHMTC	CHMTC	ASARCO	ASARCO
REMARKS	BOTTLE			SPLIT	REPLICATE		SPLIT	REPLICATE	REPLICATE	
REMARKS	ROLL TEST									
SAMPLE NUMBER		8704-1	8704-20		8705-50	8705-47			8707-02	8707-01
PHYSICAL PARAMETERS										
WATER TEMPERATURE (C)			7.5			9.7				
SPEC. COND. (UMHOS/CM) FIELD			2235		2268	2265			2137	2150
SPEC. COND. (UMHOS/CM) LAB	115	1950	2250			2320				2400
PH FIELD			6.16 *		7.48	7.69				7.46
PH LAB	9.9	7.77	6.81			7.52				7.55
TDS MEAS. @ 180 DEG. C	94	1842	1903 *	993		2086	2227			1912 *
OXYGEN (O) DISS			4.3			4.3				4.1
DEPTH TO SWL BELOW MP (FT)			8.74 *			8.01				
COMMON IONS										
CALCIUM (CA)	12	510	454	449.0		422	417.0	412.0		321
MAGNESIUM (MG)	0.49	20	25.5	27.40		20.2	25.10	24.90		22.9
SODIUM (NA)	5.1	76	71.5	76.6		85	72.5	71.8		74
POTASSIUM (K)	3.9	54	65	60.80		74	136.00	122.00		68
BICARBONATE (HCO3) (LAB)	<1.0	260 *	102			98				84
CARBONATE AS CO3 (LAB)	19	<1	<1			<1				<1.0
SULFATE (SO4)	10	1450	1425	1240.0		1338	1304.0			1200
CHLORIDE (CL)	18	6.0	7.0	10.0		7.0	30.0			4.0
TRACE ELEMENTS										
ARSENIC (AS) DISS	0.19	0.0325	0.0283	0.0198	0.038	0.030	0.0530	0.0320	0.057 *	0.039 *
ARSENIC (AS) +3			0.014						0.0218	0.060 *
ARSENIC (AS) +5			0.010						0.0722 *	0.0268
CADMIUM (CD) DISS	0.003	0.075	0.060	0.0720	0.051	0.051	0.0520	0.0500	0.055	0.049
COPPER (CU) DISS	0.008	0.280 *	0.193	0.2260	0.125	0.128	0.1480	0.1340	0.118	0.110
IRON (FE) DISS	0.11	<0.020	<0.020	<0.100	0.044	0.045	<0.100	<0.100	<0.020	<0.020
IRON (FE II)			0.010 *						0.060	0.080
LEAD (PB) DISS	<0.017	0.045 *	0.030 *	0.0334	0.019	0.020	0.0323	0.0432	0.016	0.021
MANGANESE (MN) DISS	<0.017	1.080	1.440	2.640	1.910	1.930	2.660	2.640	2.930	2.890
ZINC (ZN) DISS	0.023	3.580	3.700	4.450	2.830	2.890	2.860	2.820	2.500	2.300

All quantities in milligrams per liter unless otherwise noted. Blank line indicates parameter not tested.

Output Date: 03-19-1989
HWQ-6/86-R1

SUMMARY OF SLAG WATER QUALITY ANALYSES - ASARCO EAST HELENA

SITE NAME	FUMED SLAG	FUMED SLAG	UNFUMED SLAG	UNFUMED SLAG	UNFUMED SLAG	UNFUMED SLAG	UNFUMED SLAG	UNFUMED SLAG	UNFUMED SLAG
SAMPLE DATE	09/22/87	09/22/87	12/30/86	04/22/87	04/22/87	05/22/87	05/22/87	07/15/87	09/22/87
LAB	ASARCO	ASARCO	ASARCO	ASARCO	CHMTC	CHMTC	ASARCO	ASARCO	ASARCO
REMARKS	REPLICATE		BOTTLE		SPLIT	SPLIT			
REMARKS			ROLL TEST						
SAMPLE NUMBER	8709-06	8709-04		8704-24			8705-48	8707-03	8709-07
PHYSICAL PARAMETERS									
WATER TEMPERATURE (C)		16 *		10.5			10.9		17 *
SPEC. COND. (UMHOS/CM) FIELD	1368	1366		16296 *			19978	19850	
SPEC. COND. (UMHOS/CM) LAB		1350	200	16500			20200	22000	12200
PH FIELD				9.49			9.97 *	9.48	
PH LAB		7.63	10.4	9.25			9.6	9.73	9.69
TDS MEAS. @ 180 DEG. C		1114	206	14183 *	7298	18720	18523	18172 *	10984
OXYGEN (O) DISS		4.0		4.5			3.2	3.0	4.1
DEPTH TO SWL BELOW MP (FT)		7.74		8.83			7.85		7.02
COMMON IONS									
CALCIUM (CA)		126.5	17	371	437.0		361	426	345
MAGNESIUM (MG)		11	0.22	8.5	8.76		6.7	6.4	4.2
SODIUM (NA)		45	19	2900	2960.0		3890	3800	2200
POTASSIUM (K)		45	22	1950	158.00		2650	2550	1540
ALKALINITY AS CACO3 (LAB)							587		
BICARBONATE (HCO3) (LAB)		72	(1.0	486 *			(1	(1.0	(1.0
CARBONATE AS CO3 (LAB)		(1.0	36	(1			284	163	197
HYDROXIDE (OH)							38	46	30
SULFATE (SO4)		480 *	16	9200	2480.0	2463.0	1200	11750	6750
CHLORIDE (CL)		3.0	16	57	62.0	75.0	66	74	35
TRACE ELEMENTS									
ARSENIC (AS) DISS	0.075 *	0.054 *	0.31	0.620	0.5130		0.353	0.590 *	0.553
ARSENIC (AS) +3				0.400				0.550	
ARSENIC (AS) +5				0.030				0.054	
CADMIUM (CD) DISS	0.021	0.021	0.003	0.030 *	0.0063		0.003	0.005	0.003
COPPER (CU) DISS	0.055	0.056	0.008	0.130	0.1190		0.128	0.085	0.043
IRON (FE) DISS	(0.020	(0.020	0.070	0.150	(0.100		0.225 *	(0.020	(0.020
IRON (FE II)	0.02	(0.01		(0.010				0.070	(0.01
LEAD (PB) DISS	0.023	0.026	0.083	0.098 *	0.1430		0.0505	0.021 *	0.094
MANGANESE (MN) DISS	1.590	1.540	(0.017	0.155 *	0.139		0.083	0.090	0.050
ZINC (ZN) DISS	0.813	0.788 *	0.053	0.100 *	0.090		0.048	0.030	0.023

All quantities in milligrams per liter unless otherwise noted. Blank line indicates parameter not tested. Output Date: 03-19-1989

TABLE 1
East Helena

SLAG SAMPLE LEACHATE ANALYSIS

1979

979 SARCO ab No.	Description	(PPM in Leachate) As	Ba	Cd	Cr	Pb	Hg	Se	Ag	(Zn)
3278	Slag 1 (3)	.018	.3	.08	<.01	.6	<.001	<.005	<.01	3.5
3279	Slag 2 (2)	<.014	.1	.13	<.01	<.1	<.001	<.005	<.01	2.6
3280	Slag 3 (2)	.020	.1	.03	<.01	3.4	<.001	<.005	<.01	2.1
3281	Slag 4 (2)	<.014	.2	<.01	<.01	<.1	<.001	<.005	<.01	1.0
3282	Slag 5 (Pb)	.032	.2	<.01	<.01	3.3	<.001	<.005	<.01	5.0
3	Slag 6 (Pb)	<.014	.1	.15	<.01	1.0	<.001	<.005	<.01	6.0
aximum Contaminant evels for Non-oxic Leachates		0.5	10.0	0.1	0.5	0.5	.02	0.1	0.5	---*

NOTE →

* Currently unspecified but estimated to be 50 ppm (10 times the Drinking Water Standard).

ASARCO Incorporated
Department of Environmental Sciences
EAST HELENA
Miscellaneous Sample Results

ASARCO LAB #	SAMPLE DESCRIPTION	1985 SAMPLE DATE	As ppm	Cd ppm	Pb ppm
3658 Air Cooled	Blast Furnace Slag	5/ 7	.12	.002	5.3
3659 Granulated	Blast Furnace Slag	5/ 7	.047	<.002	.050

ASARCO Incorporated
Department of Environmental Sciences
EAST HELENA
Miscellaneous Sample Results

ASARCO LAB #	SAMPLE DESCRIPTION	1985 SAMPLE DATE	Ag ppm	As ppm	Ba ppm	Cd ppm	Cr ppm
7860	TCLP-Fumed Blast Furnace Slag	10/21	<.002	.45	4.6	.007	.016
7861	TCLP-Unfumed Blast Furnace Slag	10/21	<.002	1.2	1.6	.25	.016

ASARCO LAB #	SAMPLE DESCRIPTION	1985 SAMPLE DATE	Hg ppb	Pb ppm	Se ppm
7860	TCLP-Fumed Blast Furnace Slag	10/21	<.005	.28	.004
7861	TCLP-Unfumed Blast Furnace Slag	10/21	<.001	10.	.010

ASARCO Incorporated
Department of Environmental Sciences
EAST HELENA
Miscellaneous Sample Results

ASARCO LAB #	SAMPLE DESCRIPTION	1985 SAMPLE DATE	Ag ppm	As ppm	Ba ppm	Cd ppm	Cr ppm
6378	Air Cooled Slag	8/15	<.005	.012	<1.0	.002	<.17
6379	Granulated Slag	8/15	<.005	.010	<1.0	<.002	<.17

ASARCO LAB #	SAMPLE DESCRIPTION	1985 SAMPLE DATE	Hg ppb	Pb ppm	Se ppm	pH
6378	Air Cooled Slag	8/15	<.50	1.1	<.080	9.2
6379	Granulated Slag	8/15	<.50	.050	<.080	8.0

ASARCO Incorporated
Department of Environmental Sciences
EAST HELENA
Miscellaneous Sample Results

ASARCO LAB #	SAMPLE DESCRIPTION	1983 SAMPLE DATE	Pb ppm	Cd ppm	Cr ppm	Ag ppm	Ba ppm
11370	2-4 mo. old Slag Composite	11/28	9.8	3.9	<.030	<.008	7.2
11371	1 week old Slag Composite	11/28	3.9	<.004	<.030	<.008	8.7

ASARCO LAB #	SAMPLE DESCRIPTION	1983 SAMPLE DATE	As ppm	Se ppm	Hg ppb	pH
11370	2-4 mo. old Slag Composite	11/28	.20	.012	<.50	10.
11371	1 week old Slag Composite	11/28	.35	<.004	<.50	10.

	ppm							
	Ba	Pb	Cd	Cr	Ag	Se	Hg	As
Maximum allowable levels of contaminants in the leachate of a non-toxic material.....	100.	5.0	1.0	5.0	5.0	1.0	.2	5.0

storage area. The sediments are being stored in a protected environment to prevent contamination of the adjacent area from dispersion of the sediments by wind and water. The sediments are located on a concrete pad to prevent contact with adjacent soils. A containment berm around the perimeter of the sediment pile diverts run-on. A geomembrane cover over the sediments prevents wind and water dispersion and eliminates subsequent generation of leachate.

Approximately 31,000 cubic yards of dewatered sediments were transported to the Lower Ore Storage Area. Four thousand cubic yards of these sediments were smelted prior to the stockpile being covered with a geomembrane liner in October 1997. The sediments will remain in this interim storage facility while EPA considers Asarco's request to modify the sediment smelting requirement of the ROD, and instead dispose of these materials in the on-site CAMU.

4.1.4 Slag

The effect of the slag pile on groundwater and surface water was evaluated as part of the 1990 Comprehensive RI/FS. The evaluation was conducted in accordance with procedures presented in the Comprehensive RI/FS Work Plan (Hydrometrics 1987). Based on the results of the evaluation, the RI/FS concluded that the potential for impacts to groundwater and surface water from slag is low and the subsequent ROD did not specify any remedial action for the Slag Pile Operable Unit. Post-RI/FS monitoring at adjacent surface water and groundwater monitoring sites is on-going. A summary of the slag investigation and the findings of the RI relative to slag are presented below.

4.1.4.1 Investigation of Potential Groundwater Impacts

Slag Infiltration Test Basin Construction, Water Level Measurement, Water Quality Sampling and Analysis

Infiltration and percolation of precipitation into the slag pile were directly measured in slag test basins constructed in fumed and unfumed slag. Fumed slag is a by-product of the zinc

recovery process, which consisted of air injection into molten slag to recover zinc oxide. Unfumed slag is a by-product of the blast furnace which has not been further processed through the zinc recovery process. The zinc recovery process was suspended in 1982 and zinc is no longer recovered from the slag. Since 1982, unfumed slag has been placed in an area segregated from fumed slag.

Two slag infiltration catchment basins were constructed; one in a typical location in the fumed slag, and one in a typical location in unfumed slag. Construction of the test basins included removal of a 2 to 3 meter layer of slag, placement of an impervious 36-mil reinforced Hypalon liner in the excavation, installation of a collection sump, and replacement of the slag. Figure 4-1-8 shows the slag test basin design.

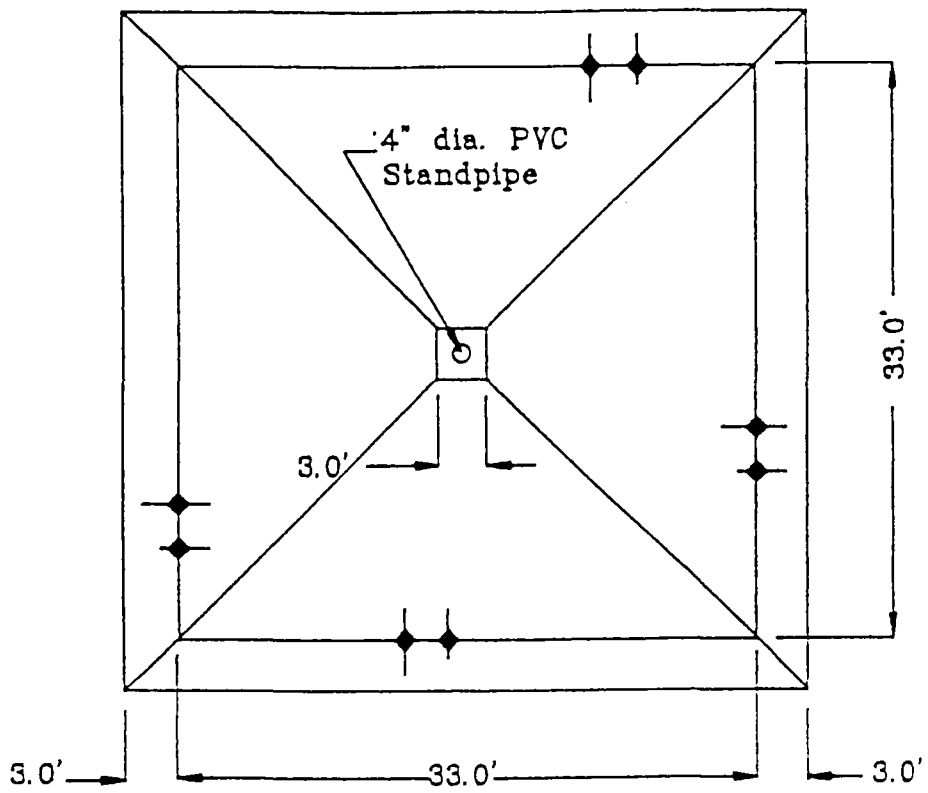
Water elevations in the collection sumps were measured periodically, and after rainfall or snowmelt events to determine the actual accumulation of water in the slag basins. Collected water was pumped from the sump, sent to the TSC laboratory, and tested for the parameters listed in Table 3-2-2. Analytical results of water collected in the test basins are summarized in Appendix 4-1-2.

Slag Material Sampling and Analysis

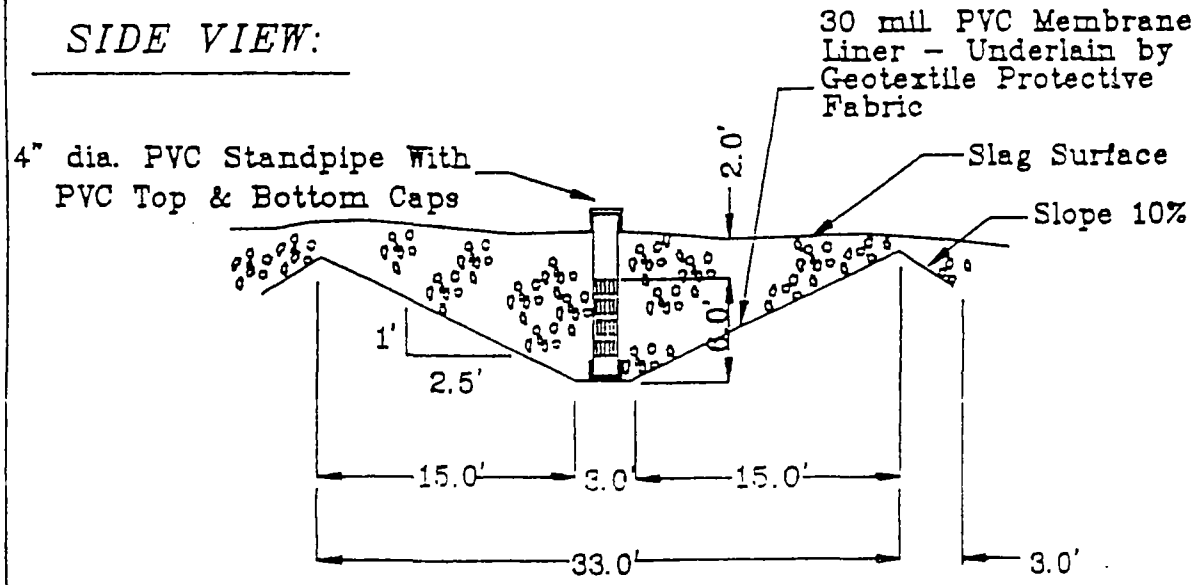
To supplement slag information collected from the test basins, samples of slag were collected from the test basin sites and sent to the TSC lab for "bottle roll" tests. Estimates of slag leachability were obtained by conducting "bottle roll" test on slag samples. Bottle roll tests involved placing samples of slag in bottles in the laboratory, adding deionized water, agitating the bottles for approximately 24 hours, then analyzing the water for concentrations of arsenic and metals. Details of the bottle roll extraction tests are in the Quality Assurance Project Plan (QAPP) Addendum to the Phase II Water Resources Investigation Work Plan (Hydrometrics, 1986). Bottle roll test results are in Appendix 4-1-2.

FIGURE 4-1-8 SLAG TEST BASIN DESIGN

PLAN VIEW:



SIDE VIEW:



NOTE: PVC Standpipe is schedule 40, capped on both ends and perforated with saw-cut slots from 2.0' to 8.0' beneath the slag surface.

In addition to the slag sampling and bottle roll test performed as part of the East Helena RI activities, additional slag samples were collected and analyzed using the EP toxicity procedure. Results of these analyses are also in Appendix 4-1-2.

Assessment of Groundwater Impacts

In an effort to estimate infiltration rates, the volume of water retained in the slag test basins was calculated for 13 time intervals, beginning December 23, 1986 and ending February 10, 1988. These volumes were compared to the volumes of precipitation during the same periods and converted to percentages, as summarized in Table 4-1-10. The percentage of precipitation retained in the basins varied from -6.7% to 61.9% in the fumed slag, and -45% to 61.8% in the unfumed slag (negative percentages indicate evaporation rates exceed precipitation collected in the test basins). Although there is a relationship of test basin water level fluctuations to precipitation (see Figures 4-1-9 and 4-1-10), the relationship may be complicated by variable evaporation, hence, infiltration rates are variable.

Concentrations of arsenic and metals from test basin water samples (see Appendix 4-1-2) were low compared to plant area groundwater. Dissolved arsenic varied from 0.0198 mg/l to 0.075 mg/l in the fumed slag, and 0.353 to 0.590 mg/l in the unfumed slag during the study period. Dissolved cadmium varied from 0.003 to 0.075 mg/l in the fumed slag, and 0.003 to 0.0063 mg/l in the unfumed slag. Dissolved lead varied from 0.016 to 0.045 mg/l in the fumed slag, and 0.021 to 0.098 mg/l in the unfumed slag.

The concentrations of arsenic and metals from bottle roll testing (See Appendix 4-1-2) were similar to the slag test basin water quality. For the fumed slag, dissolved arsenic was 0.19 mg/l, cadmium was 0.003 mg/l, and lead was less than 0.017 mg/l. For the unfumed slag, dissolved arsenic was 0.31 mg/l, cadmium was 0.003 mg/l and lead was 0.083 mg/l.

EP toxicity tests (see Appendix 4-1-2) indicate that leachable trace element concentrations from the slag are variable. From 18 tests, the results for arsenic varied from below detection level to 1.2 ppm with an average of 0.16 ppm; cadmium varied from below detection level to

TABLE 4-1-10. PRECIPITATION COLLECTED IN SLAG TEST BASINS

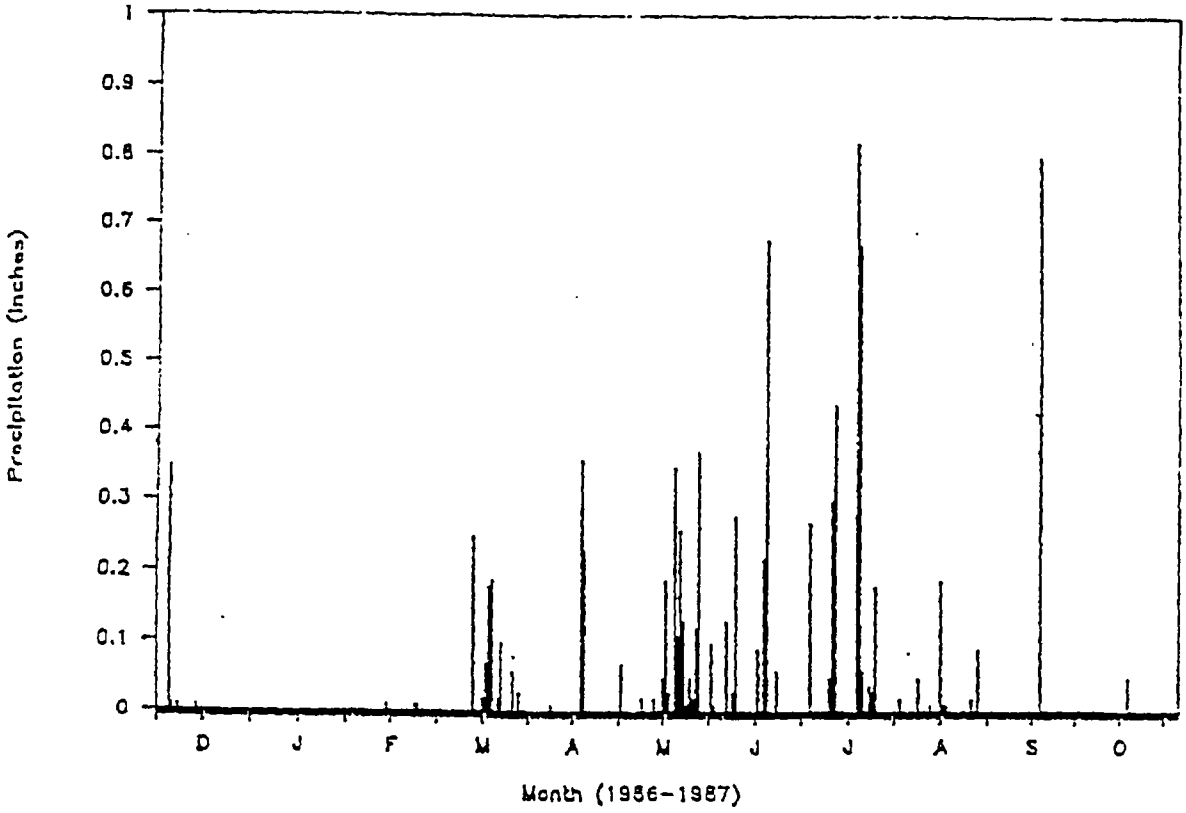
FUMED SLAG			
Date	Precipitation (inches)	Precipitation Retained * (Inches)	Percent of Precipitation Retained
12/23/86			
1/22/86	0		
2/23/87	0		
3/26/87	0.75	0.01	1.4
4/21/87	0.23	-0.01	-5.8
5/18/87	0.51	0.32	61.9
6/18/87	2.46	0.49	19.8
7/14/87	0.88	0.25	28.7
8/11/87	1.70	0.36	21.2
9/11/87	0.37	not calculated	
10/14/87	0.65	0.25	38.4
12/7/87	0.45	-0.02	-3.9
1/20/88	0.34	-0.02	-6.7
2/10/88	0.49	-0.01	-1.1
UNFUMED SLAG			
12/23/86			
1/22/87	0		
2/23/87	0		
3/26/87	0.75	0	
4/21/87	0.23	0.12	52.7
5/18/87	0.51	0.27	53.6
6/18/87	2.46	0.73	29.8
7/14/87	0.88	0.28	31.7
8/11/87	1.70	0.12	7.2
9/11/87	0.37	not calculated	
10/14/87	0.65	0.40	61.8
12/7/87	0.45	-0.05	-12.1
1/20/88	0.34	-0.15	-45.0
2/10/88	0.49	0.14	27.6

* Value is calculated based on measured water level changes and test basin geometry (Frustum of a general pyramid). Negative values indicate evaporation exceeds infiltration.

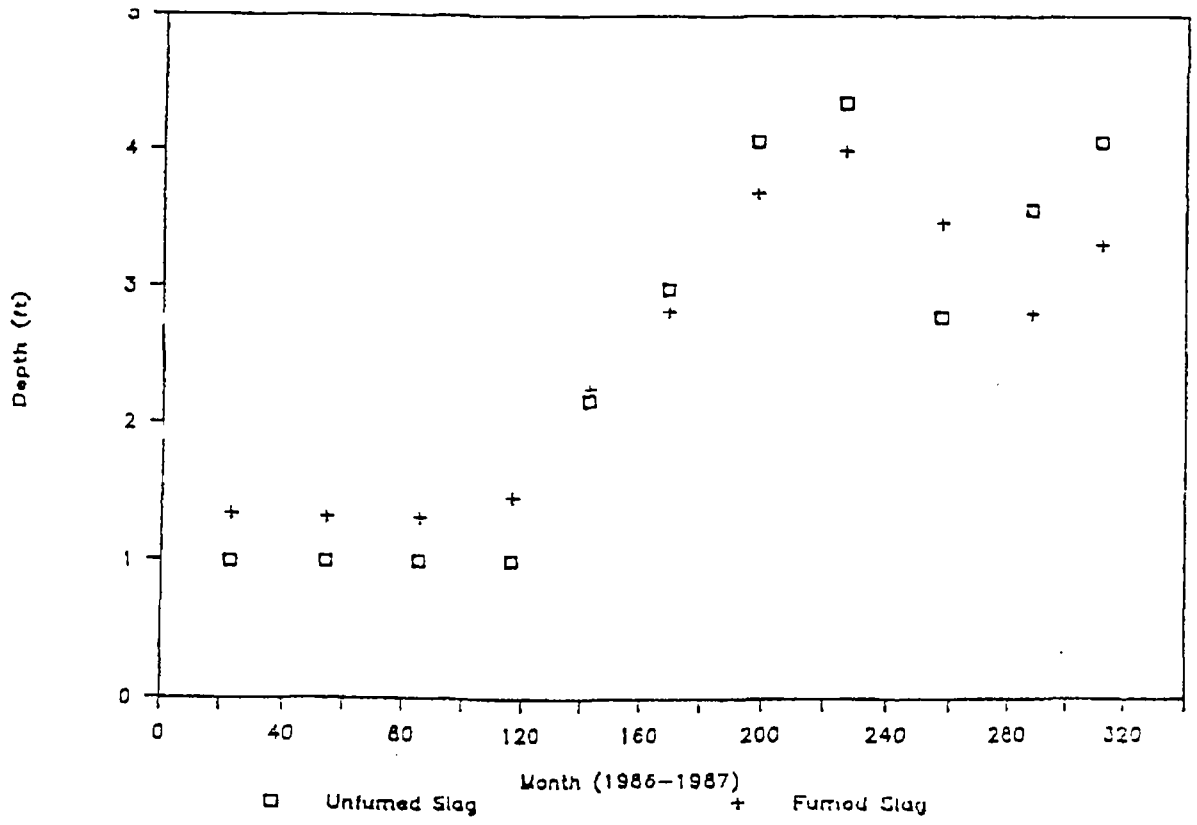
Poor Quality Source Document

The following document images have been scanned from the best available source copy.

To view the actual hard copy, contact the Region VIII Records Center at (303) 312-6473.



CC/RA REPORT ASARCO EAST HELENA FACILITY	DAILY PRECIPITATION AT HELENA AIRPORT	FIGURE 4-1-9



CC/RA REPORT ASARCO EAST HELENA FACILITY	DEPTH OF WATER IN SLAG TEST BASIN	FIGURE 4-1-10

3.9 ppm, with an average of 0.26 ppm (only one cadmium value was greater than 0.25 ppm; if the 3.9 ppm value is dropped, the cadmium average concentration is 0.04 ppm); lead values varied from below detection level to 30 ppm, with an average of 5.2 ppm.

The EP Toxicity tests were not conducted as part of the Comprehensive RI/FS activities, but have been included as supplementary data. The EP Toxicity results tend to overpredict the mobility of metals compared to the other test results and observed site conditions due to the low pH of the extractant. In particular, the values for lead appear to be much higher with TCLP than with natural conditions.

Concentrations of arsenic and other metals in the groundwater system are discussed in detail in Section 4.4. In general, results of water quality from the slag basins and bottle roll analyses of slag indicate arsenic concentrations are significantly lower than concentrations observed in monitoring wells both upgradient and downgradient of the slag pile. Figures 4-1-11, 4-1-12, 4-1-13 and 4-1-14 show a comparison to slag test basin water quality, bottle roll test water quality, EP Tox test results, and groundwater quality upgradient and down gradient of the slag pile.

Based on observed recharge rates in the slag test basins and associated water quality data, the slag pile would account for only 1 to 3 percent of the observed arsenic at downgradient monitoring well DH-10 (see Figure 4-1-15). Concentrations of arsenic in these wells are similar to arsenic concentrations in DH-4 near Lower Lake, the apparent source of elevated arsenic in these wells. Based on the results of test basin water quality analyses and bottle roll te2sts, it is unlikely that slag significantly effects observed arsenic concentration trends on the site.

While EP-Toxicity results indicate that there is some potential for mobility of cadmium, lead and zinc from slag, the results of the test basins and bottle roll tests indicate metals concentrations released from slag is low. In addition, concentrations of cadmium, lead and

FIGURE 4-1-11. ARSENIC CONCENTRATION DATA FROM GROUNDWATER MONITORING WELLS IN THE SLAG PILE AREA, AND FROM SLAG TEST BASIN AND SLAG LEACHABILITY TESTING RESULTS

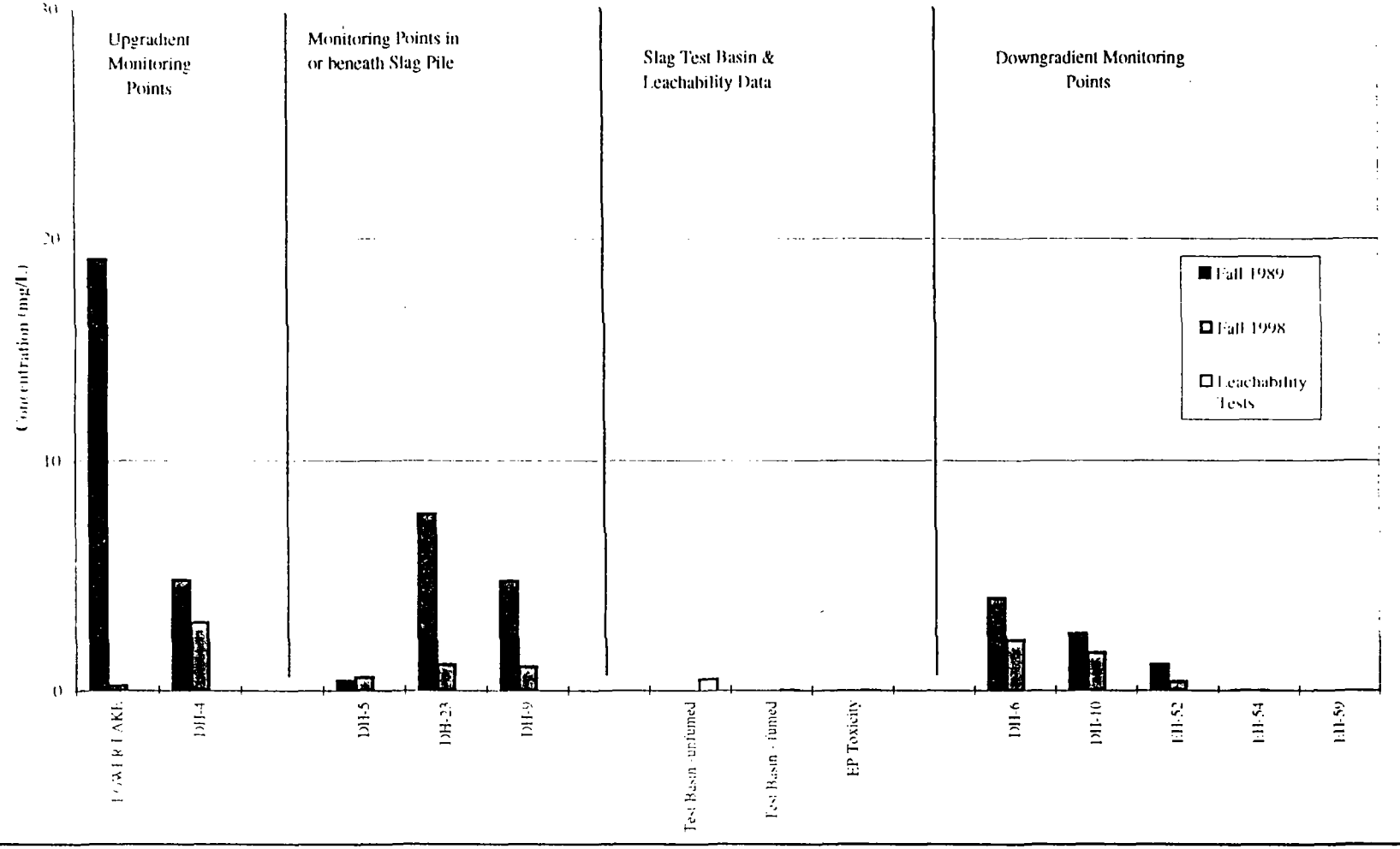


FIGURE 4-1-12. CADMIUM CONCENTRATION DATA FROM GROUNDWATER MONITORING WELLS IN THE SLAG PILE AREA, AND FROM SLAG TEST BASIN AND SLAG LEACHABILITY TESTING RESULTS

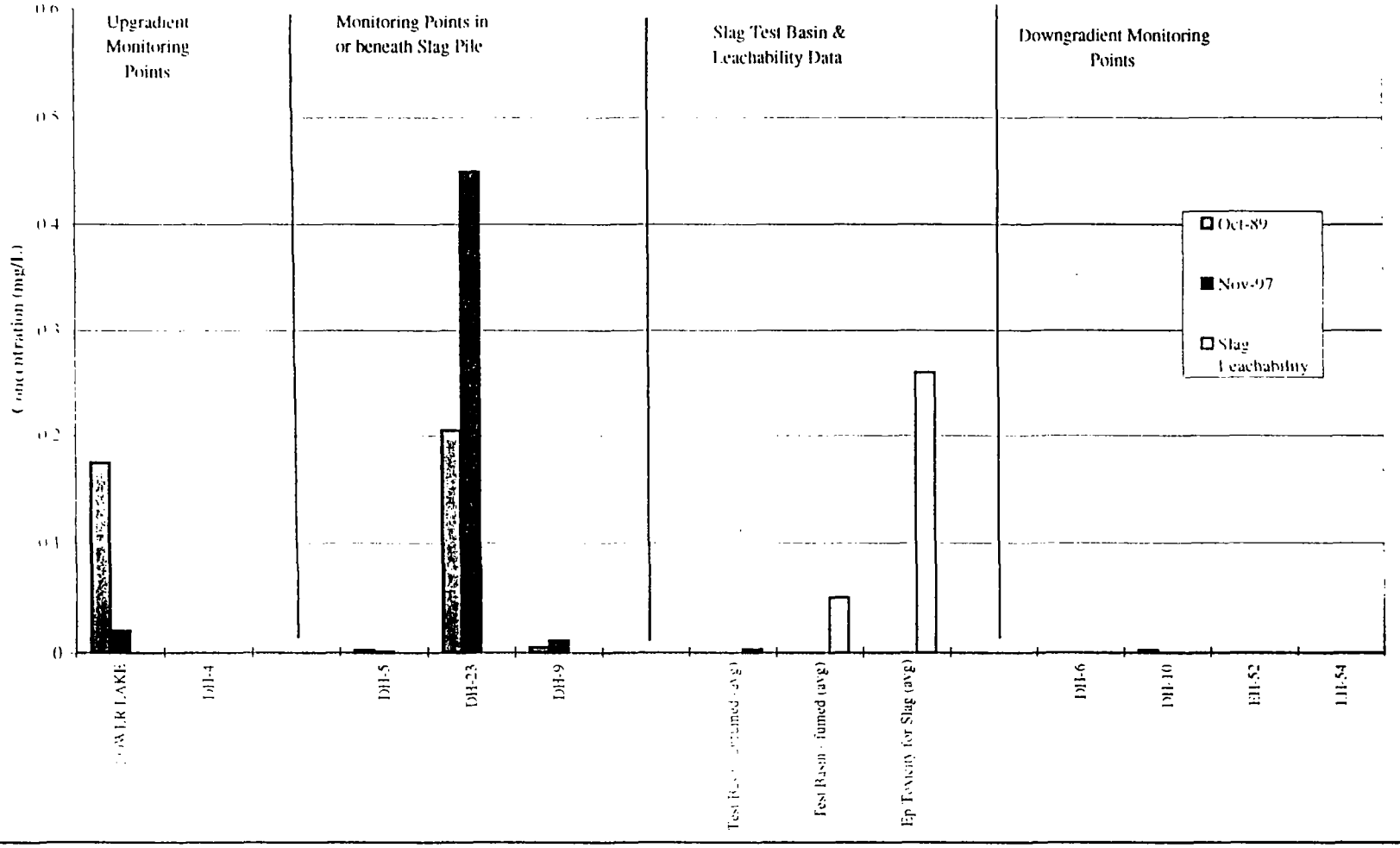


FIGURE 4-1-13. LEAD CONCENTRATION DATA FROM GROUNDWATER MONITORING WELLS IN THE SLAG PILE AREA, AND FROM SLAG TEST BASIN AND SLAG LEACHABILITY TESTING RESULTS

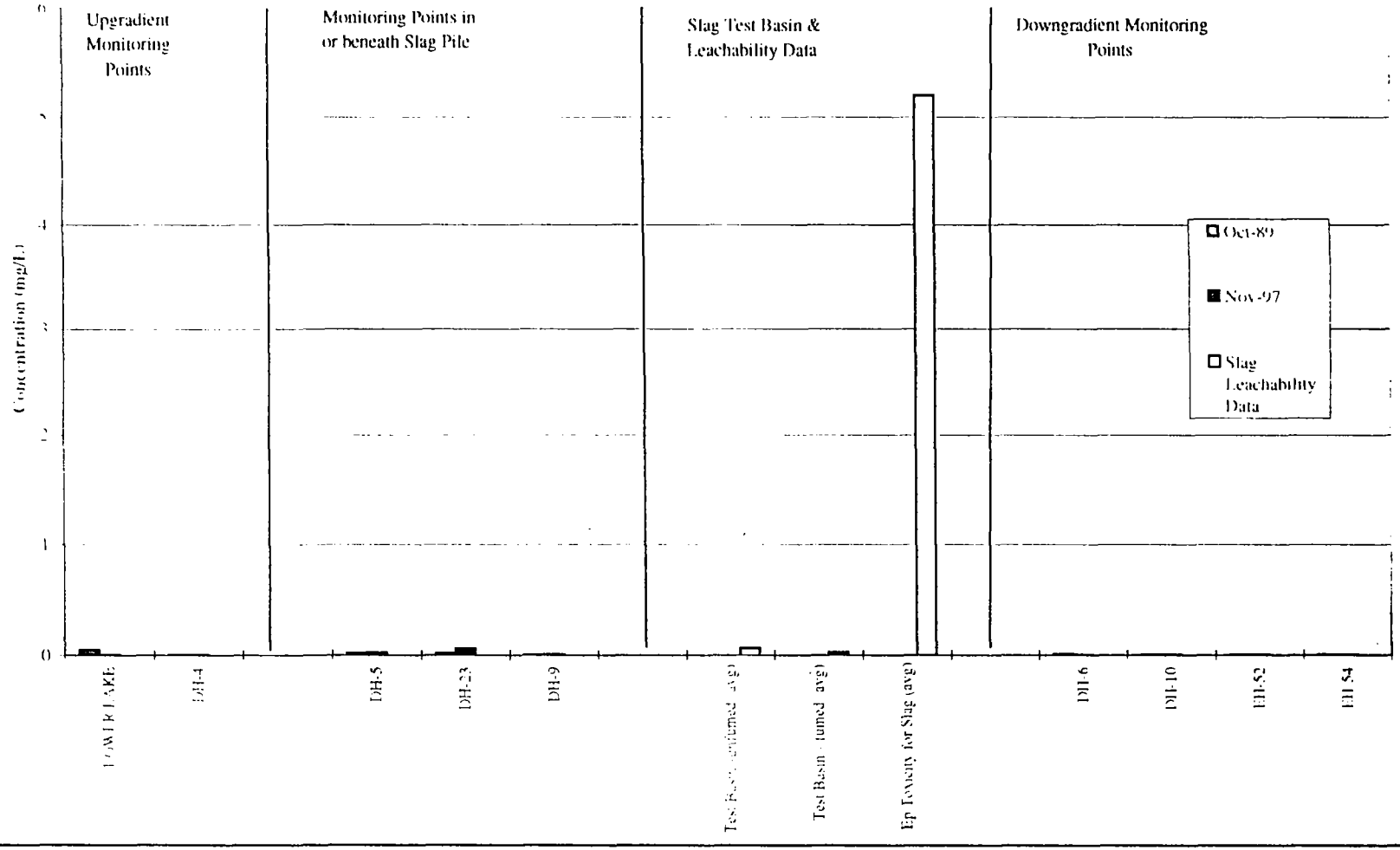


FIGURE 4-1-14. ZINC CONCENTRATION DATA FROM GROUNDWATER MONITORING WELLS IN THE SLAG PILE AREA, AND FROM SLAG TEST BASIN AND SLAG LEACHABILITY TESTING RESULTS

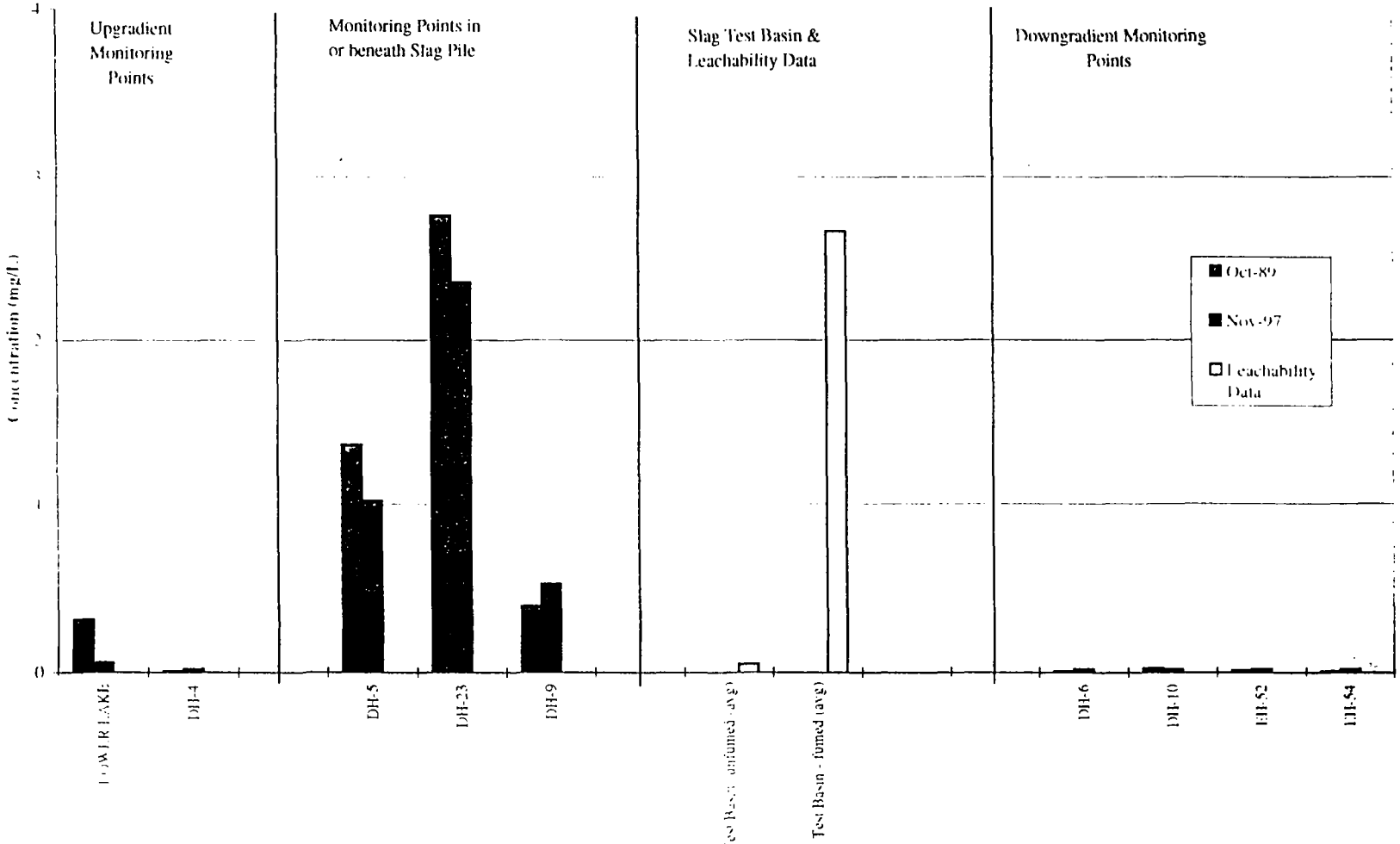


FIGURE 4-1-15. CALCULATED ARSENIC LOADING FROM SLAG VS ARSENIC LOAD IN DOWN-GRADIENT GROUNDWATER

Data Source	Arsenic Conc.(1)	Arsenic Load (2)	% of GW Load (3)
Test Basin Data			
Fumed Slag	0.036 mg/L	0.003 lb/day	0.20%
Unfumed Slag	0.53 mg/L	0.044 lb/day	2.40%
Average	0.28 mg/L	0.022 lb/day	1.30%
Max	0.59 mg/L	0.047 lb/day	2.60%
EP toxicity (avg. of 18 tests)	0.16 mg/L	0.013 lb/day	0.70%
Groundwater Load	2.13 mg/L (4)	1.8 lb/day (4)	

Notes

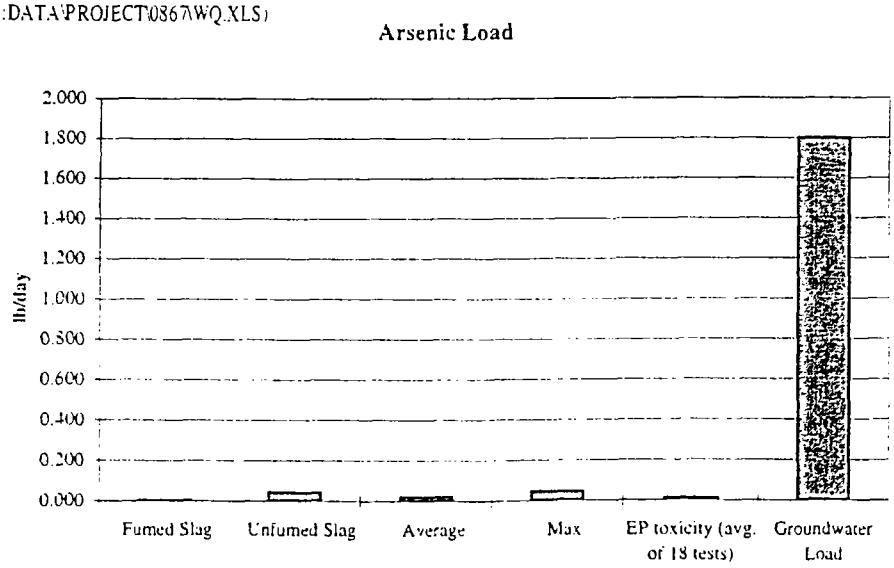
(1) Source RI/FS Appendix 6-1

(2) Slag load calculations assume:
20% infiltration (slag test basin average)
11.3 in/yr ppt
57 acre slag pile area

(3) Calculations based on 1.8 lb/day GW arsenic load assuming.
east side groundwater flux of 70 gpm
east side groundwater arsenic concentration of 2.13 mg/L

(4) Groundwater Load assumptions
Groundwater As Concetration 2.13 mg/L (avg from DH-10)
Groundwater flux = 70 gpm

(K:DATA\PROJECT\0867\WQ.XLS)



zinc is also very low. Based on the results of test basin water quality analyses, bottle roll tests, and down gradient groundwater quality, it is unlikely that slag effects observed groundwater quality trends on the site.

Stratigraphic cross-sections showing the slag pile and underlying stratigraphy (Figure 4-1-16) shows the relationship of the slag pile and underlying strata, including the perched alluvial horizon and the underlying coarser grained alluvial aquifer. Based on monitoring well stratigraphy, it is likely the perched horizon at least partially underlies the slag pile. However, there is no evidence of the perched horizon in downgradient wells (see DH-6 and DH-10). As a result, direct impacts from the slag pile at these wells is unlikely since the perched horizon is absent, and the wells are completed in the coarse grained alluvium. However, as noted above, test basin and laboratory test results indicate potential water quality impacts from the slag are low and are not responsible for the water quality concentration observed in downgradient wells.

4.1.4.2 Potential Surface Water Impacts

The potential for runoff transport in the slag pile area is very low due to the coarse, granular nature of the slag pile, which allows extremely rapid infiltration. Even during high precipitation events no runoff has been observed from the slag pile. Similarly seeps from the face of the slag pile have not been observed. The potential for impacts to surface water are, therefore, limited to direct contact and erosion of the slag pile where it forms steep sided banks adjacent to Prickly Pear Creek. Prickly Pear Creek is in immediate contact with the slag pile between PPC-5 and PPC-6, and adjacent to the slag pile from PPC-6 to PPC-7 (see Exhibit 3-2-1).

The 1990 Comprehensive RI/FS (Hydrometrics, 1990a) examined water quality data from Prickly Pear Creek to assess the potential impact of the slag pile on the creek. No consistent concentration or load increases were apparent in Prickly Pear Creek adjacent to the slag pile (between PPC-5 and PPC-7). The RI/FS therefore concluded that the contribution of arsenic and metals to surface water from slag is very minor. RI/FS and Post RI/FS water quality data

for Prickly Pear Creek are presented and discussed in Section 4.3 of this report and post-RI/FS water quality data are generally consistent with the RI/FS findings. Average metal concentrations show only small differences between stations PPC 5, PPC 7 and PPC 8 (see Figure 4-1-17). Only one high flow stream event (May 1994) shows a pronounced increase in total arsenic load between PPC-5 and PPC-7 (see Figure 4-3-9 in Section 4.3); however, arsenic concentrations decreased from PPC-5 to PPC-7 in the May 1994 event. The calculated load increase is therefore entirely a function of the flow measurement. Since the accuracy of the flow measurements is poor during higher flow events due to increased velocities and turbulence (particularly at PPC-5 below the dam) the apparent load increase during May 1994 is probably the result of flow measurement error. The conclusion of the surface water analysis is that there is little evidence for transport of arsenic and metals from the slag pile with the possible exception being direct erosion of the slag during infrequent high stream flow events.

~~1.2~~4.2 PROCESS FLUIDS

As part of the Comprehensive RI/FS (Hydrometrics 1990a), the Process Fluids Operable Unit was divided into two sub-units: Process Ponds and Process Fluid Transport Circuits.

~~1.1.1~~4.2.1 Process Ponds

The Process Ponds include:

- Lower Lake,
- Former Thornock Lake, and
- The acid plant water treatment facility.

As described in Sections 1 and 3, the Process Ponds were addressed by the Process Ponds RI/FS (Hydrometrics, 1989), a subsequent Process Ponds ROD (US EPA, 1989), and several RD/RA documents, and remedial actions that consisted primarily of sediment excavation. The 1989 Process Pond RI consisted of:

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

East Helena

Technical Services (Project 3101)

Batch No: L010790

LAB NO	DATE COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	HOLD DAYS	METHOD
L010790-002	23-MAY-01	FUMED ASARCO SLAG	AG	0.003	%	MJF	18-JUN-01		ICP
			AL	2.32	%	MJF	18-JUN-01		ICP
			AS	0.022	%	MJF	18-JUN-01		ICP
			BA	0.34	%	MJF	18-JUN-01		ICP
			BE	<0.02	%	MJF	18-JUN-01		ICP
			CR	0.036	%	MJF	18-JUN-01		ICP
			CU	0.32	%	MJF	18-JUN-01		ICP
			HG	2.7	ppm	MO	21-JUN-01		COLD VAPOR AA
			MN	1.37	%	MJF	18-JUN-01		ICP
			NI	<0.02	%	MJF	18-JUN-01		ICP
			PB	0.036	%	MJF	18-JUN-01		ICP
			SB	0.026	%	MJF	18-JUN-01		ICP
			SE	<0.02	%	MJF	18-JUN-01		ICP
			TL	<0.02	%	MJF	18-JUN-01		ICP
			V	<0.02	%	MJF	18-JUN-01		ICP
			ZN	1.63	%	MJF	18-JUN-01		ICP

ASARCO TECHNICAL SERVICES CENTER

ANALYTICAL DATA REPORT

East Helena

Technical Services (Project 3101)

Batch No: L010791

LAB NO	DATE COLLECTED	DESCRIPTION	PARAMETER	VALUE	UNITS	ANALYST	DATE ANALYZED	HOLD DAYS	METHOD
L010791-002	23-MAY-01	FUMED ASARCO SLAG (TCLP)	AG	<0.050	ppm	ESH	08-JUN-01		6010
			AS	<0.10	ppm	ESH	08-JUN-01		6010
			BA	1.4	ppm	ESH	08-JUN-01		6010
			BE	<0.005	ppm	ESH	08-JUN-01		6010
			CD	<0.050	ppm	ESH	08-JUN-01		6010
			CR	<0.10	ppm	ESH	08-JUN-01		6010
			HG	<0.50	ppb	MO	07-JUN-01		7470
			NI	<0.10	ppm	ESH	08-JUN-01		6010
			PB	0.23	ppm	ESH	08-JUN-01		6010
			PH	9.2	pH	MO	05-JUN-01		150.1
			SE	<0.10	ppm	ESH	08-JUN-01		6010
			TL	<0.10	ppm	ESH	08-JUN-01		6010
			V	<0.10	ppm	ESH	08-JUN-01		6010
			ZN	17	ppm	ESH	08-JUN-01		6010

Approved

Reviewer

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

ANALYTICAL SUMMARY REPORT

May 02, 2005

Iver Johnson
MT DEQ
PO Box 200901
Helena, MT 59620

COPY

Workorder No.: H05040130

Project Name: ASARCO Slag Pile

Energy Laboratories Inc received the following 10 samples from MT DEQ on 4/14/2005 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H05040130-001	ASP01-B3	04/14/05 14:15	04/14/05	Solid	Metals by ICP/ICPMS, Total Mercury in Solid By CVAA Digestion, Total Metals Digestion, Mercury by CVAA
H05040130-002	ASP02-B5	04/14/05 14:21	04/14/05	Solid	Same As Above
H05040130-003	ASP03-B14	04/14/05 14:28	04/14/05	Solid	Metals by ICP/ICPMS, Total Chloride, Sulfate Mercury in Solid By CVAA Moisture Moisture Polychlorinated Biphenyls (PCB's) pH Digestion, Total Metals Digestion, Mercury by CVAA Saturated Paste Extraction Sonication Extraction Soil Sonication Extraction Semi-Volatile Organic Compounds, PAHs Volatile Organics, Methanol Extraction 8260-Volatile Organic Compounds - Short List
H05040130-004	ASP04-C4	04/14/05 14:37	04/14/05	Solid	Metals by ICP/ICPMS, Total Mercury in Solid By CVAA Digestion, Total Metals Digestion, Mercury by CVAA
H05040130-005	ASP05-C9	04/14/05 14:44	04/14/05	Solid	Metals by ICP/ICPMS, Total Chloride, Sulfate Mercury in Solid By CVAA Moisture Moisture Polychlorinated Biphenyls (PCB's) pH Digestion, Total Metals Digestion, Mercury by CVAA Saturated Paste Extraction Sonication Extraction Soil Sonication Extraction Semi-Volatile Organic Compounds, PAHs Volatile Organics, Methanol Extraction 8260-Volatile Organic Compounds - Short List

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

H05040130-006	ASP06-D16	04/14/05 14:50 04/14/05	Solid	Metals by ICP/ICPMS, Total Mercury in Solid By CVAA Digestion, Total Metals Digestion, Mercury by CVAA
H05040130-007	ASP07-F3	04/14/05 14:57 04/14/05	Solid	Same As Above
H05040130-008	ASP08-G2	04/14/05 15:04 04/14/05	Solid	Metals by ICP/ICPMS, Total Chloride, Sulfate Mercury in Solid By CVAA Moisture Moisture Polychlorinated Biphenyls (PCB's) pH Digestion, Total Metals Digestion, Mercury by CVAA Saturated Paste Extraction Sonication Extraction Soil Sonication Extraction Semi-Volatile Organic Compounds, PAHs Volatile Organics, Methanol Extraction 8260-Volatile Organic Compounds - Short List
H05040130-009	ASP09-G4	04/14/05 15:07 04/14/05	Solid	Metals by ICP/ICPMS, Total Mercury in Solid By CVAA Digestion, Total Metals Digestion, Mercury by CVAA
H05040130-010	ASP10-H16	04/14/05 15:15 04/14/05	Solid	Same As Above

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative or Report.

If you have any questions regarding these tests results, please call.

Report Approved By: Deborah C. Gumm

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-001
Client Sample ID: ASP01-B3

Report Date: 05/02/05
Collection Date: 04/14/05 14:15
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Antimony	34.9	mg/kg		5.0		SW6020	04/27/05 00:49 / rlh
Arsenic	130	mg/kg		5.0		SW6020	04/27/05 00:49 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 03:48 / jjw
Cadmium	3.1	mg/kg		1.0		SW6010B	04/20/05 19:24 / jjw
Chromium	60.8	mg/kg		5.0		SW6010B	04/20/05 19:24 / jjw
Cobalt	164	mg/kg		5.0		SW6010B	04/20/05 19:24 / jjw
Iron	196000	mg/kg	D	40		SW6010B	04/20/05 19:28 / jjw
Lead	134	mg/kg		5.0		SW6010B	04/20/05 19:28 / jjw
Manganese	11400	mg/kg		5.0		SW6010B	04/22/05 03:48 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 13:51 / KC
Nickel	8.4	mg/kg		5.0		SW6010B	04/20/05 19:24 / jjw
Phosphorus	652	mg/kg		10		SW6010B	04/22/05 03:48 / jjw
Selenium	6.4	mg/kg		5.0		SW6020	04/27/05 00:49 / rlh
Zinc	13200	mg/kg		5.0		SW6010B	04/20/05 19:28 / jjw

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-002
Client Sample ID: ASP02-B5

Report Date: 05/02/05
Collection Date: 04/14/05 14:21
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Antimony	46.7	mg/kg		5.0		SW6020	04/27/05 00:56 / rlh
Arsenic	135	mg/kg		5.0		SW6020	04/27/05 00:56 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 03:51 / jjw
Cadmium	4.1	mg/kg		1.0		SW6010B	04/20/05 19:32 / jjw
Chromium	59.4	mg/kg		5.0		SW6010B	04/20/05 19:32 / jjw
Cobalt	207	mg/kg		5.0		SW6010B	04/20/05 19:32 / jjw
Iron	243000	mg/kg	D	80		SW6010B	04/22/05 03:51 / jjw
Lead	140	mg/kg		5.0		SW6010B	04/20/05 19:32 / jjw
Manganese	11700	mg/kg		5.0		SW6010B	04/22/05 03:51 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 13:57 / KC
Nickel	20.4	mg/kg		5.0		SW6020	04/27/05 00:56 / rlh
Phosphorus	584	mg/kg		10		SW6010B	04/22/05 03:51 / jjw
Selenium	8.5	mg/kg		5.0		SW6020	04/27/05 00:56 / rlh
Zinc	16900	mg/kg		5.0		SW6010B	04/22/05 03:51 / jjw

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5686 • 3161 East Lyndale Ave • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-003
Client Sample ID: ASP03-B14

Report Date: 05/02/05
Collection Date: 04/14/05 14:28
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	0.500	wt%		0.0100		SW3550A	04/22/05 08.15 / MC
CHEMICAL CHARACTERISTICS							
pH, 1:2	8.6	s.u.		0.1		ASA10-3	04/25/05 16:18 / srm
Chloride, 1:2	1.99	mg/kg		1.00		ASA10-3	04/26/05 11:49 / qed
METALS, TOTAL							
Antimony	33.7	mg/kg		5.0		SW6020	04/27/05 01:03 / rlh
Arsenic	118	mg/kg		5.0		SW6020	04/27/05 01:03 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 04:02 / jjw
Cadmium	2.6	mg/kg		1.0		SW6010B	04/20/05 19:35 / jjw
Chromium	67.1	mg/kg		5.0		SW6010B	04/20/05 19:35 / jjw
Cobalt	117	mg/kg		5.0		SW6010B	04/20/05 19:35 / jjw
Iron	264000	mg/kg	D	80		SW6010B	04/22/05 04:02 / jjw
Lead	63.8	mg/kg		5.0		SW6010B	04/20/05 19:35 / jjw
Manganese	13200	mg/kg		5.0		SW6010B	04/22/05 04:02 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 13:59 / KC
Nickel	14.5	mg/kg		5.0		SW6020	04/27/05 01:03 / rlh
Phosphorus	612	mg/kg		10		SW6010B	04/22/05 04:02 / jjw
Selenium	8.4	mg/kg		5.0		SW6020	04/27/05 01:03 / rlh
Zinc	13500	mg/kg		5.0		SW6010B	04/22/05 04:02 / jjw
VOLATILE ORGANIC COMPOUNDS							
Bromoform	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Benzene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Bromobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Bromochloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Bromodichloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Bromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Carbon tetrachloride	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Chlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Chloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
2-Chloroethyl vinyl ether	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Chloroform	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Chloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
2-Chlorotoluene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
4-Chlorotoluene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Chlorodibromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,2-Dibromoethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Dibromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,2-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-003
Client Sample ID: ASP03-B14

Report Date: 05/02/05
Collection Date: 04/14/05 14:28
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,3-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,4-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Dichlorodifluoromethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,1-Dichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,2-Dichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
cis-1,2-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,1-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
trans-1,2-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,2-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,3-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
2,2-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,1-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
cis-1,3-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
trans-1,3-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Ethylbenzene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Methyl tert-butyl ether (MTBE)	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Methylene chloride	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Methyl ethyl ketone	ND	mg/kg		4.0		SW8260B	04/21/05 16:42 / trr
Styrene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,1,1,2-Tetrachloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,1,2,2-Tetrachloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Tetrachloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Toluene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,1,1-Trichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,1,2-Trichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Trichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Trichlorofluoromethane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
1,2,3-Trichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Vinyl chloride	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
m+p-Xylenes	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
o-Xylene	ND	mg/kg		0.20		SW8260B	04/21/05 16:42 / trr
Surr: p-Bromofluorobenzene	134	%REC			78-160	SW8260B	04/21/05 16:42 / trr
Surr: Dibromofluoromethane	116	%REC			70-132	SW8260B	04/21/05 16:42 / trr
Surr: 1,2-Dichloroethane-d4	114	%REC			60-136	SW8260B	04/21/05 16:42 / trr
Surr: Toluene-d8	120	%REC			75-138	SW8260B	04/21/05 16:42 / trr
SEMI-VOLATILE ORGANIC COMPOUNDS							
Acenaphthene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Acenaphthylene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Benzo(a)anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm

Report Definitions: RL - Analyte reporting limit. MCL - Maximum contaminant level.
QCL - Quality control limit. ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-003
Client Sample ID: ASP03-B14

Report Date: 05/02/05
Collection Date: 04/14/05 14:28
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
SEMI-VOLATILE ORGANIC COMPOUNDS							
Benzo(a)pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Benzo(b)fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Benzo(g,h,i)perylene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Benzo(k)fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Chrysene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Dibenzo(a,h)anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Fluorene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Indeno(1,2,3-cd)pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Naphthalene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Phenanthrene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 13:56 / sm
Surr: 2-Fluorobiphenyl	82.5	%REC			30-115	SW8270C	04/21/05 13:56 / sm
Surr: *Nitrobenzene-d5*	83.7	%REC			23-120	SW8270C	04/21/05 13:56 / sm
Surr: Terphenyl-d14	98.6	%REC			18-137	SW8270C	04/21/05 13:56 / sm
POLYCHLORINATED BIPHENYLS (PCB'S)							
Aroclor 1016	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Aroclor 1221	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Aroclor 1232	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Aroclor 1242	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Aroclor 1248	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Aroclor 1254	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Aroclor 1260	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Aroclor 1262	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Aroclor 1268	ND	mg/kg		0.017		SW8082	04/24/05 03:13 / law
Surr: Decachlorobiphenyl	96.0	%REC			50-126	SW8082	04/24/05 03:13 / law
Surr: Tetrachloro-m-xylene	86.0	%REC			42-115	SW8082	04/24/05 03:13 / law

Sample extract received a Sulfuric Acid Clean-up (EPA Method 3665) and a Sulfur Clean-up (EPA Method 3660) prior to analysis.

Report Definitions: RL - Analyte reporting limit. MCL - Maximum contaminant level.
QCL - Quality control limit. ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 3658 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-004
Client Sample ID: ASP04-C4

Report Date: 05/02/05
Collection Date: 04/14/05 14:37
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Antimony	43.5	mg/kg		5.0		SW6020	04/27/05 01:10 / rlh
Arsenic	155	mg/kg		5.0		SW6020	04/27/05 01:10 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 04:06 / jjw
Cadmium	5.1	mg/kg		1.0		SW6010B	04/20/05 19:39 / jjw
Chromium	71.2	mg/kg		5.0		SW6010B	04/20/05 19:39 / jjw
Cobalt	212	mg/kg		5.0		SW6010B	04/20/05 19:39 / jjw
Iron	273000	mg/kg	D	80		SW6010B	04/22/05 04:06 / jjw
Lead	364	mg/kg		5.0		SW6010B	04/20/05 19:39 / jjw
Manganese	12200	mg/kg		5.0		SW6010B	04/22/05 04:06 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 14:01 / KC
Nickel	22.9	mg/kg		5.0		SW6020	04/27/05 01:10 / rlh
Phosphorus	586	mg/kg		10		SW6010B	04/22/05 04:06 / jjw
Selenium	12.1	mg/kg		5.0		SW6020	04/27/05 01:10 / rlh
Zinc	17900	mg/kg		5.0		SW6010B	04/22/05 04:06 / jjw

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 3658 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-005
Client Sample ID: ASP05-C9

Report Date: 05/02/05
Collection Date: 04/14/05 14:44
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	0.800	wt%		0.0100		SW3550A	04/22/05 08:15 / MC
CHEMICAL CHARACTERISTICS							
pH, 1:2	9.0	s.u.		0.1		ASA10-3	04/25/05 16:18 / srm
Chloride, 1:2	2.89	mg/kg		1.00		ASA10-3	04/26/05 12:13 / qed
METALS, TOTAL							
Antimony	37.1	mg/kg		5.0		SW6020	04/27/05 01:44 / rlh
Arsenic	117	mg/kg		5.0		SW6020	04/27/05 01:44 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 04:13 / jjw
Cadmium	3.1	mg/kg		1.0		SW6010B	04/20/05 19:42 / jjw
Chromium	74.4	mg/kg		5.0		SW6010B	04/20/05 19:42 / jjw
Cobalt	153	mg/kg		5.0		SW6010B	04/20/05 19:42 / jjw
Iron	262000	mg/kg	D	80		SW6010B	04/22/05 04:13 / jjw
Lead	160	mg/kg		5.0		SW6010B	04/20/05 19:42 / jjw
Manganese	11800	mg/kg		5.0		SW6010B	04/22/05 04:13 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 14:04 / KC
Nickel	15.9	mg/kg		5.0		SW6020	04/27/05 01:44 / rlh
Phosphorus	707	mg/kg		10		SW6010B	04/22/05 04:13 / jjw
Selenium	12.7	mg/kg		5.0		SW6020	04/27/05 01:44 / rlh
Zinc	18500	mg/kg		5.0		SW6010B	04/22/05 04:13 / jjw
VOLATILE ORGANIC COMPOUNDS							
Bromoform	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Benzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Bromobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Bromochloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Bromodichloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Bromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Carbon tetrachloride	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Chlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Chloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
2-Chloroethyl vinyl ether	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Chloroform	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Chloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
2-Chlorotoluene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
4-Chlorotoluene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Chlorodibromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,2-Dibromoethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Dibromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,2-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES
ENERGY LABORATORIES, INC. • P.O. Box 3658 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-005
Client Sample ID: ASP05-C9

Report Date: 05/02/05
Collection Date: 04/14/05 14:44
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,3-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,4-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Dichlorodifluoromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,1-Dichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,2-Dichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
cis-1,2-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,1-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
trans-1,2-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,2-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,3-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
2,2-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,1-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
cis-1,3-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
trans-1,3-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Ethylbenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Methyl tert-butyl ether (MTBE)	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Methylene chloride	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Methyl ethyl ketone	ND	mg/kg		4.0		SW8260B	04/21/05 17:16 / trr
Styrene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,1,1,2-Tetrachloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,1,2,2-Tetrachloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Tetrachloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Toluene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,1,1-Trichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,1,2-Trichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Trichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Trichlorofluoromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
1,2,3-Trichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Vinyl chloride	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
m+p-Xylenes	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
o-Xylene	ND	mg/kg		0.20		SW8260B	04/21/05 17:16 / trr
Surr: p-Bromofluorobenzene	118	%REC			78-160	SW8260B	04/21/05 17:16 / trr
Surr: Dibromofluoromethane	104	%REC			70-132	SW8260B	04/21/05 17:16 / trr
Surr: 1,2-Dichloroethane-d4	104	%REC			60-136	SW8260B	04/21/05 17:16 / trr
Surr: Toluene-d8	104	%REC			75-138	SW8260B	04/21/05 17:16 / trr
SEMI-VOLATILE ORGANIC COMPOUNDS							
Acenaphthene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Acenaphthylene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Benzo(a)anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm

Report Definitions: RL - Analyte reporting limit. MCL - Maximum contaminant level.
QCL - Quality control limit. ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-005
Client Sample ID: ASP05-C9

Report Date: 05/02/05
Collection Date: 04/14/05 14:44
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
SEMI-VOLATILE ORGANIC COMPOUNDS							
Benzo(a)pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Benzo(b)fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Benzo(g,h,i)perylene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Benzo(k)fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Chrysene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Dibenzo(a,h)anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Fluorene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Indeno(1,2,3-cd)pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Naphthalene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Phenanthrene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 14:39 / sm
Surr: 2-Fluorobiphenyl	88.6	%REC			30-115	SW8270C	04/21/05 14:39 / sm
Surr: Nitrobenzene-d5	86.9	%REC			23-120	SW8270C	04/21/05 14:39 / sm
Surr: Terphenyl-d14	98.9	%REC			18-137	SW8270C	04/21/05 14:39 / sm
POLYCHLORINATED BIPHENYLS (PCB'S)							
Aroclor 1016	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Aroclor 1221	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Aroclor 1232	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Aroclor 1242	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Aroclor 1248	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Aroclor 1254	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Aroclor 1260	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Aroclor 1262	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Aroclor 1268	ND	mg/kg		0.017		SW8082	04/24/05 03:40 / law
Surr: Decachlorobiphenyl	140	%REC	S		50-126	SW8082	04/24/05 03:40 / law
Surr: Tetrachloro-m-xylene	108	%REC			42-115	SW8082	04/24/05 03:40 / law

Sample extract received a Sulfuric Acid Clean-up (EPA Method 3665) and a Sulfur Clean-up (EPA Method 3660) prior to analysis

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
S - Spike recovery outside of advisory limits.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-006
Client Sample ID: ASP06-D16

Report Date: 05/02/05
Collection Date: 04/14/05 14:50
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Antimony	42.5	mg/kg		5.0		SW6020	04/27/05 01:51 / rlh
Arsenic	130	mg/kg		5.0		SW6020	04/27/05 01:51 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 04:17 / jjw
Cadmium	2.2	mg/kg		1.0		SW6010B	04/20/05 19:46 / jjw
Chromium	68.4	mg/kg		5.0		SW6010B	04/20/05 19:46 / jjw
Cobalt	173	mg/kg		5.0		SW6010B	04/20/05 19:46 / jjw
Iron	305000	mg/kg	D	80		SW6010B	04/22/05 04:17 / jjw
Lead	55.5	mg/kg		5.0		SW6010B	04/20/05 19:46 / jjw
Manganese	11800	mg/kg		5.0		SW6010B	04/22/05 04:17 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 14:06 / KC
Nickel	18.8	mg/kg		5.0		SW6020	04/27/05 01:51 / rlh
Phosphorus	647	mg/kg		10		SW6010B	04/22/05 04:17 / jjw
Selenium	11.0	mg/kg		5.0		SW6020	04/27/05 01:51 / rlh
Zinc	19100	mg/kg		5.0		SW6010B	04/22/05 04:17 / jjw

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-007
Client Sample ID: ASP07-F3

Report Date: 05/02/05
Collection Date: 04/14/05 14:57
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Antimony	42.7	mg/kg		5.0		SW6020	04/27/05 01:58 / rlh
Arsenic	102	mg/kg		5.0		SW6020	04/27/05 01:58 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 04:20 / jjw
Cadmium	1.9	mg/kg		1.0		SW6010B	04/20/05 19:49 / jjw
Chromium	70.5	mg/kg		5.0		SW6010B	04/20/05 19:49 / jjw
Cobalt	171	mg/kg		5.0		SW6010B	04/20/05 19:49 / jjw
Iron	286000	mg/kg	D	80		SW6010B	04/22/05 04:20 / jjw
Lead	45.3	mg/kg		5.0		SW6010B	04/20/05 19:49 / jjw
Manganese	12100	mg/kg		5.0		SW6010B	04/22/05 04:20 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 14:10 / KC
Nickel	17.4	mg/kg		5.0		SW6020	04/27/05 01:58 / rlh
Phosphorus	578	mg/kg		10		SW6010B	04/22/05 04:20 / jjw
Selenium	13.8	mg/kg		5.0		SW6020	04/27/05 01:58 / rlh
Zinc	19100	mg/kg		5.0		SW6010B	04/22/05 04:20 / jjw

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5638 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-008
Client Sample ID: ASP08-G2

Report Date: 05/02/05
Collection Date: 04/14/05 15:04
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Moisture	0.800	wt%		0.0100		SW3550A	04/22/05 08:15 / MC
CHEMICAL CHARACTERISTICS							
pH, 1:2	9.2	s.u.		0.1		ASA10-3	04/25/05 16:18 / srm
Chloride, 1:2	1.06	mg/kg		1.00		ASA10-3	04/26/05 12:48 / qed
METALS, TOTAL							
Antimony	43.8	mg/kg		5.0		SW6020	04/27/05 02:05 / rlh
Arsenic	119	mg/kg		5.0		SW6020	04/27/05 02:05 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 04:24 / jjw
Cadmium	2.5	mg/kg		1.0		SW6010B	04/20/05 20:00 / jjw
Chromium	59.8	mg/kg		5.0		SW6010B	04/20/05 20:00 / jjw
Cobalt	194	mg/kg		5.0		SW6010B	04/20/05 20:00 / jjw
Iron	290000	mg/kg	D	80		SW6010B	04/22/05 04:24 / jjw
Lead	118	mg/kg		5.0		SW6010B	04/20/05 20:00 / jjw
Manganese	13100	mg/kg		5.0		SW6010B	04/22/05 04:24 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 14:12 / KC
Nickel	17.9	mg/kg		5.0		SW6020	04/27/05 02:05 / rlh
Phosphorus	720	mg/kg		10		SW6010B	04/22/05 04:24 / jjw
Selenium	9.9	mg/kg		5.0		SW6020	04/27/05 02:05 / rlh
Zinc	21100	mg/kg		5.0		SW6010B	04/22/05 04:24 / jjw
VOLATILE ORGANIC COMPOUNDS							
Bromoform	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Benzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Bromobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Bromochloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Bromodichloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Bromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Carbon tetrachloride	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Chlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Chloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
2-Chloroethyl vinyl ether	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Chloroform	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Chloromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
2-Chlorotoluene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
4-Chlorotoluene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Chlorodibromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,2-Dibromoethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Dibromomethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,2-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-008
Client Sample ID: ASP08-G2

Report Date: 05/02/05
Collection Date: 04/14/05 15:04
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
VOLATILE ORGANIC COMPOUNDS							
1,3-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,4-Dichlorobenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Dichlorodifluoromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,1-Dichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,2-Dichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
cis-1,2-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,1-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
trans-1,2-Dichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,2-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,3-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
2,2-Dichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,1-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
cis-1,3-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
trans-1,3-Dichloropropene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Ethylbenzene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Methyl tert-butyl ether (MTBE)	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Methylene chloride	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Methyl ethyl ketone	ND	mg/kg		4.0		SW8260B	04/21/05 17:51 / trr
Styrene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,1,1,2-Tetrachloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,1,2,2-Tetrachloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Tetrachloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Toluene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,1,1-Trichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,1,2-Trichloroethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Trichloroethene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Trichlorofluoromethane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
1,2,3-Trichloropropane	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Vinyl chloride	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
m+p-Xylenes	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
o-Xylene	ND	mg/kg		0.20		SW8260B	04/21/05 17:51 / trr
Surr: p-Bromofluorobenzene	118	%REC			78-160	SW8260B	04/21/05 17:51 / trr
Surr: Dibromofluoromethane	103	%REC			70-132	SW8260B	04/21/05 17:51 / trr
Surr: 1,2-Dichloroethane-d4	102	%REC			60-136	SW8260B	04/21/05 17:51 / trr
Surr: Toluene-d8	108	%REC			75-138	SW8260B	04/21/05 17:51 / trr
SEMI-VOLATILE ORGANIC COMPOUNDS							
Acenaphthene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Acenaphthylene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Benzo(a)anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit. MCL - Maximum contaminant level. ND - Not detected at the reporting limit

ENERGY LABORATORIES, INC. • P.O. Box 5685 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-008
Client Sample ID: ASP08-G2

Report Date: 05/02/05
Collection Date: 04/14/05 15:04
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
SEMI-VOLATILE ORGANIC COMPOUNDS							
Benzo(a)pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Benzo(b)fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Benzo(g,h,i)perylene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Benzo(k)fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Chrysene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Dibenzo(a,h)anthracene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Fluoranthene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Fluorene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Indeno(1,2,3-cd)pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Naphthalene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Phenanthrene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Pyrene	ND	mg/kg		0.33		SW8270C	04/21/05 15:21 / sm
Surr: 2-Fluorobiphenyl	75.9	%REC			30-115	SW8270C	04/21/05 15:21 / sm
Surr: Nitrobenzene-d5	76.0	%REC			23-120	SW8270C	04/21/05 15:21 / sm
Surr: Terphenyl-d14	88.9	%REC			18-137	SW8270C	04/21/05 15:21 / sm
POLYCHLORINATED BIPHENYLS (PCB'S)							
Aroclor 1016	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Aroclor 1221	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Aroclor 1232	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Aroclor 1242	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Aroclor 1248	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Aroclor 1254	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Aroclor 1260	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Aroclor 1262	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Aroclor 1268	ND	mg/kg		0.017		SW8082	04/24/05 04:08 / law
Surr: Decachlorobiphenyl	125	%REC			50-126	SW8082	04/24/05 04:08 / law
Surr: Tetrachloro-m-xylene	90.0	%REC			42-115	SW8082	04/24/05 04:08 / law

Sample extract received a Sulfuric Acid Clean-up (EPA Method 3665) and a Sulfur Clean-up (EPA Method 3660) prior to analysis.

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-009
Client Sample ID: ASP09-G4

Report Date: 05/02/05
Collection Date: 04/14/05 15:07
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Antimony	57.6	mg/kg		5.0		SW6020	04/27/05 02:12 / rlh
Arsenic	109	mg/kg		5.0		SW6020	04/27/05 02:12 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 04:27 / jjw
Cadmium	1.4	mg/kg		1.0		SW6010B	04/20/05 20:04 / jjw
Chromium	90.0	mg/kg		5.0		SW6010B	04/20/05 20:04 / jjw
Cobalt	204	mg/kg		5.0		SW6010B	04/20/05 20:04 / jjw
Iron	294000	mg/kg	D	80		SW6010B	04/22/05 04:27 / jjw
Lead	64.0	mg/kg		5.0		SW6010B	04/20/05 20:04 / jjw
Manganese	11900	mg/kg		5.0		SW6010B	04/22/05 04:27 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 14:14 / KC
Nickel	20.6	mg/kg		5.0		SW6020	04/27/05 02:12 / rlh
Phosphorus	562	mg/kg		10		SW6010B	04/22/05 04:27 / jjw
Selenium	12.2	mg/kg		5.0		SW6020	04/27/05 02:12 / rlh
Zinc	20100	mg/kg		5.0		SW6010B	04/22/05 04:27 / jjw

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: MT DEQ
Project: ASARCO Slag Pile
Lab ID: H05040130-010
Client Sample ID: ASP10-H16

Report Date: 05/02/05
Collection Date: 04/14/05 15:15
Date Received: 04/14/05
Matrix: Solid

Analyses	Result	Units	Qual	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Antimony	34.1	mg/kg		5.0		SW6020	04/22/05 05:23 / rlh
Arsenic	117	mg/kg		5.0		SW6020	04/22/05 05:23 / rlh
Beryllium	ND	mg/kg		5.0		SW6010B	04/22/05 04:31 / jjw
Cadmium	2.1	mg/kg		1.0		SW6010B	04/20/05 20:07 / jjw
Chromium	59.0	mg/kg		5.0		SW6010B	04/20/05 20:07 / jjw
Cobalt	137	mg/kg		5.0		SW6010B	04/20/05 20:07 / jjw
Iron	305000	mg/kg	D	80		SW6010B	04/22/05 04:31 / jjw
Lead	103	mg/kg		5.0		SW6010B	04/20/05 20:07 / jjw
Manganese	10400	mg/kg		5.0		SW6010B	04/22/05 04:31 / jjw
Mercury	ND	mg/kg		1.0		SW7471A	04/25/05 14:16 / KC
Nickel	14.7	mg/kg		5.0		SW6020	04/22/05 05:23 / rlh
Phosphorus	710	mg/kg		10		SW6010B	04/22/05 04:31 / jjw
Selenium	9.1	mg/kg		5.0		SW6020	04/22/05 05:23 / rlh
Zinc	22200	mg/kg		5.0		SW6010B	04/22/05 04:31 / jjw

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

July 2006 Consent Decree Progress Report

Bench Scale Test Results for Pump and Treat Pilot Test (CDM)

ASARCO LLC

Bench Scale Test Results for Pump and Treat Pilot Test

July 21, 2006

Final

Contents

Section 1 Introduction

Section 2 Bench Test Plan

Section 3 Bench Test Results

3.1 Arsenic Oxidation Tests 3-1
3.2 Evaluation of Iron, pH, and Peroxide Oxidation 3-2
3.3 Repeatability Test Using All HDS Treatment Steps 3-4
3.4 Coagulation and Flocculation Issues 3-5

Section 4 Recommended Modifications to the Current HDS Treatment Plant Process

Section 1
Introduction

Asarco has contracted Camp Dresser and McKee Incorporated (CDM) and Hydrometrics Incorporated to complete an independent evaluation and full-scale pilot test of a pump and treat alternative for reducing the primary sources of contamination to groundwater at the East Helena smelter. The primary contaminant of concern in groundwater at the East Helena facility is arsenic. High arsenic concentrations are found in the plumes originating from the acid plant (low pH) and from the speiss area (high pH).

In September 2005, EPA recommended that future actions should focus on an evaluation of remedial actions to address the groundwater plumes emanating from the facility. EPA directed Asarco to amend the Interim Measures Work Plan to incorporate an evaluation of remedial measures that address groundwater arsenic issues.

The high density sludge (HDS) treatment plant is available at the East Helena smelter facility, which is currently being used to treat a combination of plant water and site storm water, commonly referred to as storm water. This memorandum evaluates the possibility of modifying HDS plant operations to effectively treat the arsenic contaminated speiss area groundwater. A pump and treat control option potentially could provide a cost effective and technologically sound solution for immediately addressing groundwater contamination at the East Helena facility or be used to augment source control passive treatment options such as containment slurry walls or permeable reactive barriers (PRBs). By taking these active treatment steps to reduce contaminant loading and concentrations in the groundwater, the effectiveness of any future passive treatment options may be improved, and costs reduced.

This memorandum summarizes the results of the bench scale tests performed during the spring of 2006 to determine the feasibility of treating the speiss groundwater. These results will be used to develop the pilot test protocol for treatment of groundwater in the HDS facility.

Section 2
Bench Test Plan

Bench-tests were conducted on the speiss area groundwater to evaluate the effectiveness of one or more HDS water treatment options for meeting the MPDES discharge permit limits. While arsenic is the focus of the treatment, the tests also were needed to determine whether or not the arsenic treatment process would be compatible with the treatment process(s) necessary for treatment of site stormwater. It was also necessary to determine whether or not the water could be treated within the constraints of the existing HDS plant process flow.

To be compatible with current HDS plant operations, CDM selected iron coagulation as the primary treatment mechanism for this application. Using this technology, iron in the form of ferric sulfate is added to the treatment process to remove arsenic either as an iron-arsenate solid or by adsorption of arsenic onto iron hydroxides. Since arsenic in the speiss groundwater is in the reduced As (III) valence state, the addition of hydrogen peroxide to oxidize arsenic to the As (IV) form was also evaluated.

The bench tests, as described below, were performed to investigate the need for peroxide addition, the optimum dosage of iron to remove arsenic, and the effect of pH on both peroxide oxidation and iron co-precipitation reactions. Optimization tests were conducted using speiss water since this source has the highest arsenic concentration. Final repeatability tests were completed on various mixtures of speiss water, acid plant sediment drying area water and stormwater sources at in the following volumetric ratios:

- 100% Speiss Water at the groundwater capture flow of 45 gpm (determined by Hydrometrics modeling efforts)
- 50% Speiss Water (45 gpm) and 50% Acid Plant Sediment Drying Area Water (45 gpm)
- 50% Speiss Water (45 gpm) and 50% Stormwater (45 gpm)
- 100% Stormwater

Historically, when the HDS plant is operating, Asarco treats water at an average flow of 90 gpm, which is just below the maximum HDS plant capacity of 100 gpm.

Section 3
Bench Test Results

This section summarizes the various tests that were conducted. All initial tests, including oxidation tests and optimization of iron dosage and pH, were conducted on speiss water. Once the optimum conditions were determined, final repeatability testing was conducted using all HDS water treatment plant steps for each of the four mixtures of various sources described above.

3.1 Arsenic Oxidation Tests

Arsenic oxidation tests were conducted to evaluate the effect of pH and peroxide dosage on arsenic oxidation. Tests involved adjusting the pH to the desired test range using sulfuric acid or sodium hydroxide followed by the addition of 50% hydrogen peroxide in varying dosages. The peroxide dose was varied based the molar ratio of hydrogen peroxide to arsenic. Samples were submitted to Energy Laboratories for dissolved arsenic, arsenic speciation, dissolved iron, sulfate and alkalinity. The results of the arsenic oxidation tests are shown in Table 3-1.

Table 3-1

Arsenic Oxidation Test Results

Sample ID	Description	% of Stoich Dose[1]	Rxn Time (min)	Field pH [2]	Alkalinity (mg/L as $CaCO_3$)	Sulfate (mg/L)	Arsenic (mg/L)	Iron (mg/L)	As (III)	As (V)
1-1-01	Control	0	0:18	9.6 (lab)	1,200	1,230	215	0.21	85	170
1-2-01	0.25 mL	100%	0:16	8.24	--	--	--	--	6.6	260
1-3-01	0.5 mL, init pH 3.5	200%	0:16	3.63	--	--	--	--	ND	270
1-3-02	0.5 mL, init pH 3.5	200%	0:30	3.4	--	--	--	--	ND	270
1-3-03	0.5 mL, init pH 3.5	200%	0:30	8.82	--	--	--	--	ND	280
1-3-04	0.5 mL, init pH 3.5	200%	0:20	10 (lab)	310	2,430	217	0.18	ND	270
1-4-01	0.5 mL, init pH 8	200%	0:42	8.54	--	--	--	--	ND	270
1-4-02	0.5 mL, init pH 8	200%	0:20	9.55	--	--	--	--	ND	270
1-4-03	0.5 mL, init pH 8	200%	0:20	10.4 (lab)	1,600	1,500	212	0.2	ND	260

Notes:

(1) molar ratio of hydrogen peroxide to arsenic

(2) lab pH is shown where field data was not available

Major conclusions from these tests are as follows:

- More than 50% of the arsenic was oxidized in the control jar, which involved simple mixing without the addition of hydrogen peroxide
- More than 90% of the arsenic was oxidized at the 100% stoichiometric ratio (or 0% excess)
- All of the arsenic was oxidized at molar ratios above 100% stoichiometric

- Reaction pH did not have an effect on the arsenic oxidation in these tests

The results of these tests indicate that arsenic is oxidized relatively easily in the speiss area groundwater. However, it's worth noting that the tests were conducted at essentially infinite oxidation times since there was no practical means (given the lab setup and available reagents) for preserving or stopping the oxidation reaction between sample collection and laboratory analysis. Consequently, the oxidized arsenic results may be biased high when incorporated into the full-scale HDS plant, although previous experience shows that arsenic can be successfully oxidized to low levels with peroxide in the HDS plant.

3.2 Evaluation of Iron Dosage, pH, and Peroxide Oxidation

Bench tests were completed to evaluate the effect of iron dosage, pH and peroxide oxidation on arsenic removal. Procedures involved adding iron and peroxide at the desired stoichiometric ratios and then raising the pH with caustic.

The initial iron dosage was determined from geochemical modeling using PHREEQC software. The modeling was based on the formation of the iron-arsenic precipitate strengite ($FeAsO_4$). This gave an approximate stoichiometric dosage of iron to use as a starting point for the bench tests. In reality, the arsenic would also adsorb onto iron hydroxide precipitates. The modeling indicated that approximately 800 mg/L ferric sulfate is required to remove 224 mg/L of arsenic to low levels in speiss water. Thus, the stoichiometric treatment dose used in the initial bench testing was approximately 800 mg/L ferric sulfate, which translates to an iron-to-arsenic mass ratio of 1.04:1.

Peroxide dosages were 150% of the stoichiometric required dosage (or 50% excess) for arsenic oxidation. The target pH ranged from about 3.5, 9 and 10. Samples were collected after about 45 minutes at the low pH, 25 minutes after adjustment to pH 9, and 25 minutes after adjustment to pH 10. The reaction times were the approximate residence times in the HDS plant reactor vessels.

The target effluent arsenic concentration is 5 mg/L (dissolved basis). Historical testing in the HDS plant has shown that if the dissolved arsenic concentration in the thickener overflow is below about 5 mg/L, then arsenic polishing in the second half of the HDS plant (post-HDS plant operations) is capable of meeting the discharge limits.

Table 3-2 and Figure 3-1 show the results of these tests. Major conclusions are as follows:

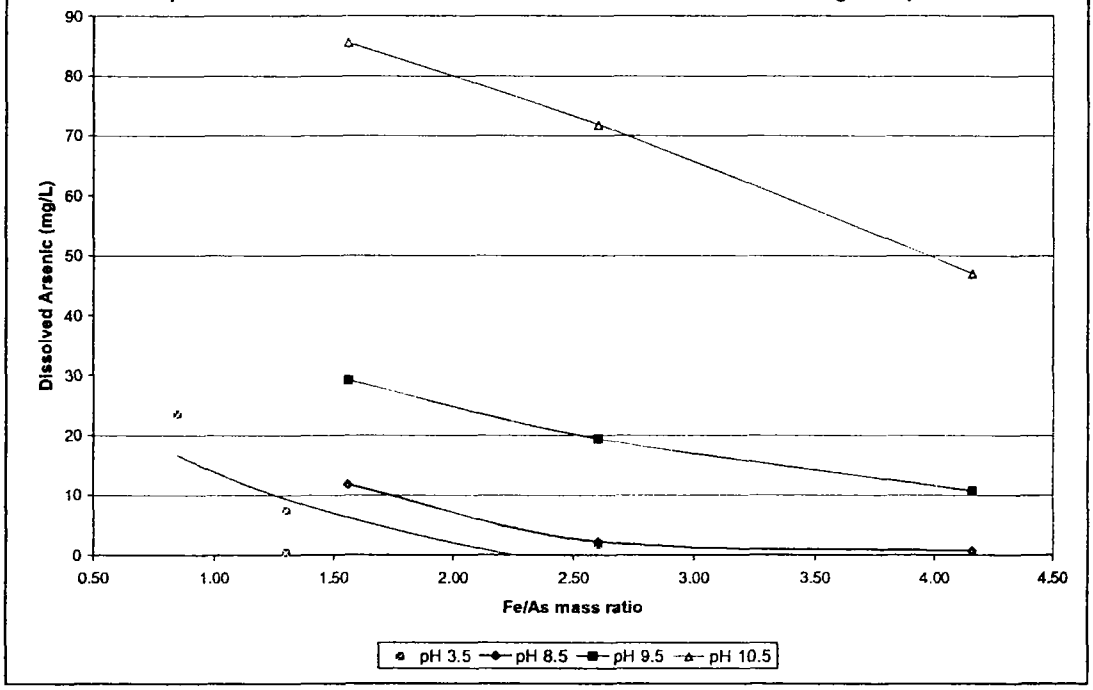
- The lowest arsenic concentrations were obtained at the lowest pH and high iron dosages

Table 3-2
Evaluation of Iron Dosage, pH and Peroxide Oxidization of Speiss Water

Jar(s)	Description	Fe:As mass ratio	Low pH		Mid pH		High pH	
			pH	As	pH	As	pH	As
			s.u.	mg/L Diss.	s.u.	mg/L Diss.	s.u.	mg/L Diss.
With Peroxide (150% Stoichiometric)								
1-5	Add ferric sulfate before peroxide	1.30	3.39	7.43	9.07	35.82	9.9	77.38
2-5	Effect of iron dosage, peroxide, and pH	0.85	3.25	23.48	8.88	68.92	10.07	111
2-3	Effect of iron dosage, peroxide, and pH	1.30	3.41	0.5	8.99	34.8	10.05	89.6
2-2	Effect of iron dosage, peroxide, and pH	2.60	3.15	1.79	9.02	8.2	10.13	55.14
Without Peroxide								
2-6	No initial pH adjustment	1.56	6.87	11.64	9.33	43.22	10.18	90.32
2-1	No initial pH adjustment	1.56	7.09	6.0	9.09	15.5	10.17	65.6
3-7, 3-4, 3-1	Effect of iron dosage and pH	1.56	8.69	11.8	9.46	29.2	10.41	85.6
3-8, 3-5, 3-2	Effect of iron dosage and pH	2.60	8.58	2.31	9.46	19.4	10.51	71.8
3-9, 3-6, 3-3	Effect of iron dosage and pH	4.16	8.54	0.77	9.49	10.7	10.54	47

Note:
Jars 2-1 and 2-6 are essentially the same experiment, jar 2-1 was supposed to be adjusted to pH 3.5, but this step was accidentally missed

Figure 3-1
Speiss Area Groundwater Arsenic Removal as a function of Iron Dosage and pH



- The higher the pH, the poorer the arsenic removal, even with high iron dosage
- The tests indicated that peroxide addition is not necessary to achieve acceptable arsenic removal

While arsenic removal was best at low pH, operating at a low pH in the neutralization tanks is not necessarily compatible with plant treatment operations for removal of metals, which generally requires a high pH. The plant currently operates at about pH 10.5 in the neutralization tanks for removal of metals. Consequently, another series of tests was performed to determine arsenic removal as a function of pH and iron dosage; however, this time the minimum pH was 8.5 instead of 3.5. These results are also included in Table 3-2.

Not surprisingly, the results indicated that arsenic was removed best at the lowest pH. For Jar 3-8, at pH 8.5 and a moderate iron-to-arsenic ratio of 2.6 to 1, the arsenic concentration was 2.3 mg/L. This concentration was determined to be close enough to the target concentration of 5 mg/L for purposes of bench-scale testing. Since increasing the iron dosage resulted in improved arsenic removal for all cases studied, the iron dosage during pilot scale testing will be fine tuned to achieve the necessary arsenic removal.

3.3 Repeatability Testing Using All HDS Treatment Steps

The last set of bench testing involved treated various mixtures of source waters using all of the treatment steps in the HDS and Post-HDS plant operations. Treatment steps consisted of the following:

HDS Plant Steps

1. Adding iron at an iron-to-arsenic ratio of 2 to 1
2. Adjusting the pH to 8.5 with caustic
3. Coagulation and flocculation
4. Collection of TSS sample of mixed slurry
5. Solids setting and decanting into new test jar

Post-HDS Plant Steps

6. Addition of iron at plant dosages
7. Addition of sulfide (mg/L as Sulfide)
8. Adjust pH to 9.5 with caustic

9. Flocculate and Settle

10. Collection of TSS sample of mixed slurry

11. Collect Samples for Analysis

The results are presented in Table 3-3. Major conclusions are as follows:

- All mixtures were successfully treated below the MPDES discharge limits, except the 100% stormwater.

- Effluent from treatment of 100% stormwater exceeded the limit for thallium. Addition of slightly more sulfide should result in meeting the thallium concentration. Alternatively, when treating stormwater only, the process could be operated at a higher pH of 10.5, as it is now, to meet the discharge limits.

- Effluent from treatment of 100% speiss water was near the discharge limit of 1.9 mg/L at 50 gpm. Addition of slightly more iron may be necessary to comfortably meet the arsenic limit on a routine basis.

3.4 Coagulation and Flocculation Issues

One of the difficulties encountered in all bench testing scenarios was coagulation, flocculation, and settling of the iron-arsenic precipitate formed during treatment of 100% speiss water. However, coagulation/flocculation and settling was less problematic when mixtures of site water were used. The iron-to-arsenic precipitate apparently forms a very fine grained, charged colloid that will not settle on its own (even after sitting for weeks). The precipitate is so fine that laboratory results for total suspended solids were non-detect because the precipitate was able to pass through the 1.5 micron filter used in the TSS analytical method.

To solve the settling problem, a polymer coagulant was added to the water prior to flocculation. Jar testing showed that only a small dosage (approximately 0.5 mg/L) was needed to improve flocculation. However, tests also showed that overdosing could lead to a reversal in particle charge and poor flocculation. Therefore, proper dosing of coagulant will be required in full-scale operations.

The current flocculant used in the treatment plant (Betz product) and Ciba "Magnafloc 156" were tested on the coagulant-treated solution. The "Magnafloc 156", which has been used in the past, performed very well. However, the Betz flocculant performed poorly. In fact, addition of the Betz flocculant gave worse results than settling with coagulant alone. Consequently, the Magnafloc 156 should be considered in the pilot test for comparison to the Betz product.

Table 3-3
HDS Plant Test Results Using Various Mixtures of Source Waters

Parameter	Units	100% Speiss Water	50% Speiss and 50% Stormwater	50% Speiss and 50% Acid Sediment Water	100% Storm water	MDPES Limits (30 day average)	
						50 gpm	90 gpm
pH	s.u.	9.2	9.1	9.0	8.0	--	--
SC	umhos/	5,590	3,370	4,620	954	--	--
TDS	mg/L	3,880	2,220	3,470	589	--	--
Alkalinity	mg/L as $CaCO_3$	52	32	100	12	--	--
Chloride	mg/L	80	49	109	24	--	--
Sulfate	mg/L	2,520	1,410	2,160	376	--	--
Fluoride	mg/L	8.7	4.6	4.4	0.6	--	--
Aluminum	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	--	--
Antimony	mg/L	0.013	0.011	0.013	0.013	1.995	1.108
Arsenic	mg/L	1.729	0.069	0.010	< 0.005	1.900	1.056
Cadmium	mg/L	< 0.001	0.003	< 0.001	< 0.001	0.229	0.127
Calcium	mg/L	< 1	2	176	34	--	--
Copper	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	1.870	1.039
Iron	mg/L	< 0.03	< 0.03	< 0.03	< 0.03	1.395	0.775
Lead	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	0.007	0.004
Magnesium	mg/L	< 1	< 1	69	5	--	--
Manganese	mg/L	< 0.01	< 0.01	0.02	< 0.01	0.198	0.110
Mercury	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	0.0013	0.0007
Potassium	mg/L	15	12	23	8	--	--
Selenium	mg/L	0.074	0.083	0.037	0.066	2.558	1.421
Silicon	mg/L	0.8	0.5	0.7	0.4	--	--
Sodium	mg/L	1,217	752	856	158	--	--
Thallium	mg/L	< 0.005	< 0.005	< 0.005	0.084	0.117	0.065
Zinc	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	1.283	0.713

Note: Shaded cells indicate elevated concentrations.

Section 4
Recommended Modifications to the Current HDS Treatment Plant Process

The bench test results indicated that the speiss water can be treated in the existing layout of the HDS plant, with only minor modifications of chemical additions and control settings. A preliminary list of recommended chemical dosages and equipment modifications to the first half of the HDS facility are as follows:

- Arsenic removal was successful at an iron-to-arsenic mass ratio of 2.08 to 1. With the current ferric sulfate solution being used at the HDS plant, the dosage rate is 2.3 mL/liter. At 45 gpm, the ferric sulfate flow would be 392 mL/min. This should be added to NT1. The resulting pH in NT1 is estimated to be approximately 7.1.

- The acidity of the ferric sulfate solution was sufficient to drop the pH of the speiss water. No acid addition appears necessary for speiss water treatment.

- Caustic should be added in NT2 to raise the pH to 8.5. The caustic dosage was approximately 0.22 mL/L, or 37 mL/min.

- Coagulant will be necessary to settle the iron arsenic colloid. Coagulant should be added at NT2. The approximate coagulant dosage is 0.5 mg/L or 85 mL/min of a 0.1 percent solution at a plant flow of 45 gpm.

- Use of the current flocculant should be discontinued. It is recommended that the flocculant be switched to Ciba "Magnafloc 156". The approximate dosage is estimated at 125 to150 mL/min at a plant flow of 45 gpm.

- The process control interlocks will need to be modified to allow operation of NT1 at approximately pH 7 and NT2 at a pH of 8.5 without plant shutdown.

July 2006 Consent Decree Progress Report

Bi-Monthly Residential Groundwater Wells

Raw Analytical Data

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

ANALYTICAL SUMMARY REPORT

July 19, 2006

Asarco LLC
PO Box 1230
East Helena, MT 59635

Workorder No.: H06070114

Project Name: RI/FS Long Term Monitoring July 2006

Energy Laboratories Inc received the following 7 samples from Asarco LLC on 7/12/2006 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H06070114-001	EHR-0706-300	07/12/06 14:00	07/12/06	Drinking Water	Metals by ICP/ICPMS. Dissolved Solids. Total Dissolved Sulfate
H06070114-002	EHR-0706-301	07/12/06 14:30	07/12/06	Drinking Water	Same As Above
H06070114-003	EHR-0706-302	07/12/06 16:30	07/12/06	Drinking Water	Same As Above
H06070114-004	EHR-0706-303	07/12/06 15:00	07/12/06	Drinking Water	Same As Above
H06070114-005	EHR-0706-304	07/12/06 15:15	07/12/06	Drinking Water	Metals by ICP/ICPMS. Dissolved
H06070114-006	EHR-0706-305	07/12/06 15:30	07/12/06	Drinking Water	Same As Above
H06070114-007	EHR-0706-306	07/12/06 17:00	07/12/06	Drinking Water	Metals by ICP/ICPMS. Dissolved Solids. Total Dissolved Sulfate

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative or Report.

If you have any questions regarding these tests results, please call.

Report Approved By: Jennifer Hayes

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070114-001
Client Sample ID: EHR-0706-300 NORDSTROM 109 GAIL STREET

Report Date: 07/19/06
Collection Date: 07/12/06 14:00
DateReceived: 07/12/06
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	179	mg/L		10		A2540 C	07/14/06 14:33 / sld
INORGANICS							
Sulfate	49	mg/L		1		A4500-SO4 E	07/18/06 14:32 / abb
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.002		E200.8	07/14/06 15:47 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES. INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070114-002
Client Sample ID: EHR-0706-301 JONES 301 GAIL STREET

Report Date: 07/19/06
Collection Date: 07/12/06 14:30
DateReceived: 07/12/06
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1010	mg/L		10		A2540 C	07/14/06 14:33 / sld
INORGANICS							
Sulfate	499	mg/L	D	2		A4500-SO4 E	07/18/06 14:33 / abb
METALS, DISSOLVED							
Arsenic	0.006	mg/L		0.002		E200.8	07/14/06 16:15 / eli-b

- The Arsenic result was confirmed by re-analysis.

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070114-003
Client Sample ID: EHR-0706-302

CORBETT
203 GAIL STREET

Report Date: 07/19/06
Collection Date: 07/12/06 16:30
DateReceived: 07/12/06
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	174	mg/L		10		A2540 C	07/14/06 14:33 / sld
INORGANICS							
Sulfate	49	mg/L		1		A4500-SO4 E	07/18/06 14:33 / abb
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.002		E200.8	07/14/06 16:22 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070114-004
Client Sample ID: EHR-0706-303 HELFERT 407 E. PORTER ST.

Report Date: 07/19/06
Collection Date: 07/12/06 15:00
DateReceived: 07/12/06
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	371	mg/L		10		A2540 C	07/14/06 14:34 / sld
INORGANICS							
Sulfate	133	mg/L		1		A4500-SO4 E	07/18/06 14:45 / abb
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.002		E200.8	07/14/06 16:29 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070114-005
Client Sample ID: EHR-0706-304 FIELD DUPLICATE. HELFERT

Report Date: 07/19/06
Collection Date: 07/12/06 15:15
DateReceived: 07/12/06
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.002		E200.8	07/14/06 16:36 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070114-006
Client Sample ID: EHR-0706-305 FIELD BLANK

Report Date: 07/19/06
Collection Date: 07/12/06 15:30
DateReceived: 07/12/06
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.002		E200.8	07/14/06 16:42 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070114-007
Client Sample ID: EHR-0706-306

JENSEN
401 GAIL STREET

Report Date: 07/19/06
Collection Date: 07/12/06 17:00
DateReceived: 07/12/06
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	553	mg/L		10		A2540 C	07/14/06 14:34 / sld
INORGANICS							
Sulfate	259	mg/L	D	1		A4500-SO4 E	07/18/06 14:46 / abb
METALS, DISSOLVED							
Arsenic	0.002	mg/L		0.002		E200.8	07/14/06 16:49 / eli-b
- The Arsenic result was confirmed by re-analysis							

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

ANALYTICAL SUMMARY REPORT

August 01, 2006

Jon Nickel
Asarco LLC
PO Box 1230
East Helena, MT 59635

Workorder No.: H06070224

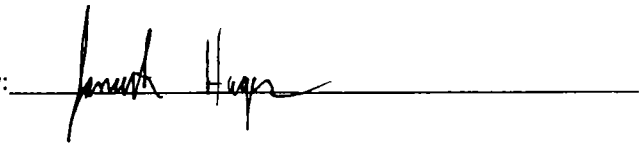
Project Name: RI/FS Long Term Monitoring July 2006

Energy Laboratories Inc received the following 4 samples from Asarco LLC on 7/21/2006 for analysis.

Sample ID	Client Sample ID	Collect Dat	Receive Dat	Matrix	Test
H06070224-001	EHR-0706-307-RAW	07/21/06 13:00	07/21/06	Groundwater	Solids, Total Dissolved Sulfate
H06070224-002	EHR-0706-307 Metal	07/21/06 13:15	07/21/06	Groundwater	Metals by ICP/ICPMS, Dissolved
H06070224-003	EHR-0706-308 Metal	07/21/06 13:30	07/21/06	Groundwater	Same As Above
H06070224-004	EHR-0706-309 Metal	07/21/06 13:45	07/21/06	Groundwater	Same As Above

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative or Report.

If you have any questions regarding these tests results, please call.

Report Approved By: 

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070224-001
Client Sample ID: EHR-0706-307-RAW

JONES
301 GAIL STREET

Report Date: 08/01/06
Collection Date: 07/21/06 13:00
DateReceived: 07/21/06
Matrix: Groundwater

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1080	mg/L		10		A2540 C	07/24/06 12:44 / sld
INORGANICS							
Sulfate	512	mg/L	D	2		A4500-SO4 E	07/25/06 14:06 / abb

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix interference.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES. INC. • P.O. Box 5688 • 3161 East Lyndale Ave. • Helena, MT 59604
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client:	Asarco LLC	**Report Date:**	08/01/06
Project:	RI/FS Long Term Monitoring July 2006	**Collection Date:**	07/21/06 13:15
Lab ID:	H06070224-002	**DateReceived:**	07/21/06
Client Sample ID:	EHR-0706-307 Metal	**Matrix:**	Groundwater

JONES
301 GAIL STREET

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, DISSOLVED							
Arsenic	0.005	mg/L		0.002		E200.8	07/27/06 06:43 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Asarco LLC
Project: RI/FS Long Term Monitoring July 2006
Lab ID: H06070224-003
Client Sample ID: EHR-0706-308 Metal JONES (DUPLICATE) 301 GAIL STREET

Report Date: 08/01/06
Collection Date: 07/21/06 13:30
DateReceived: 07/21/06
Matrix: Groundwater

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, DISSOLVED							
Arsenic	0.006	mg/L		0.002		E200.8	07/27/06 08:20 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES
877-472-0711 • 406-442-0711 • 406-442-0712 fax • helena@energylab.com

LABORATORY ANALYTICAL REPORT

Client:	Asarco LLC	**Report Date:**	08/01/06
Project:	RI/FS Long Term Monitoring July 2006	**Collection Date:**	07/21/06 13:45
Lab ID:	H06070224-004	**DateReceived:**	07/21/06
Client Sample ID:	EHR-0706-309 Metal FIELD BLANK	**Matrix:**	Groundwater

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.002		E200.8	07/27/06 08:27 / eli-b

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.